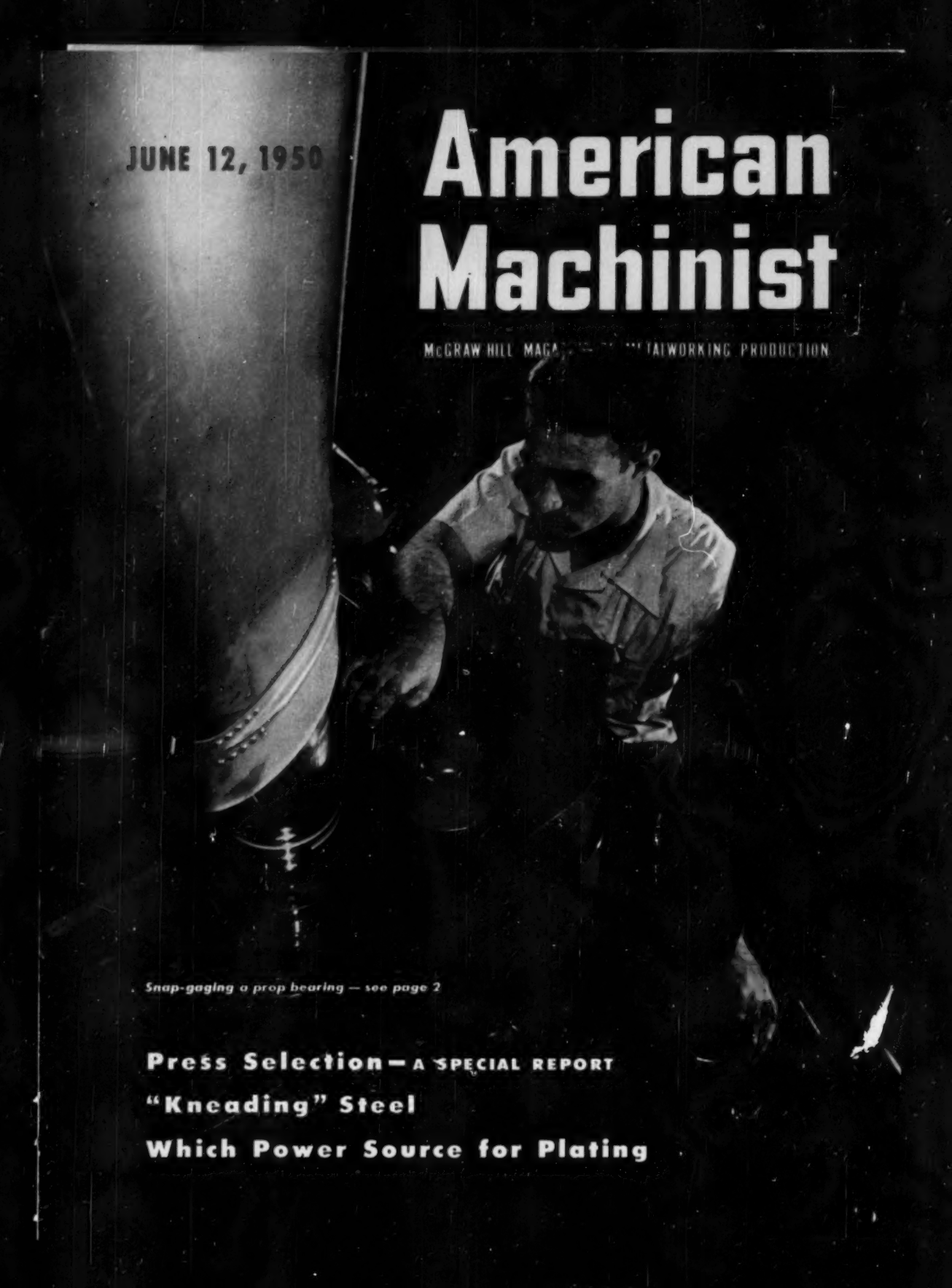
JUNE 12, 1950

American Machinist

McGRAW-HILL MAGA... METALWORKING PRODUCTION



Snap-gaging a prop bearing — see page 2

Press Selection — A SPECIAL REPORT

"Kneading" Steel

Which Power Source for Plating

for FASTER-FASTER-FASTER flow of production line parts

New Way-Type Bore-Matic doubles production and provides precision alignment for multiple borizing of cylinder blocks.

The Model 231 Bore-Matic shown above (actually two way-type units in tandem) is arranged to bore valve guide holes and generate valve seats simultaneously. Concentricity and alignment are therefore automatic and infallible. A five-station, hydraulic transfer fixture presents the work in sequence to the two sets of four boring-heads. Damped quills are used to assure better finish and prolong tool life. And completely borized cylinder heads come off the machine in half the time of the previous method.

Way-type units, adapted to conveyor-type production lines, can be arranged to meet virtually every requirement for high-speed, multiple borizing.

combine operations on a versatile Heald Bore-Matic

When one machine can do the work of two or more—when one operation can replace several—that's real economy! It means faster production with greater accuracy. It means lower cost per part, with less capital investment.

Savings like this are routine with versatile Heald Bore-Matics. Multiplicity of tooling and flexibility of machine cycles and fixture arrangements spell faster, more economical production every time.

Remember—when it comes to precision finishing, it pays to come to Heald.

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WORCESTER 6, MASSACHUSETTS

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American Machinist

MAGAZINE OF METALWORKING PRODUCTION

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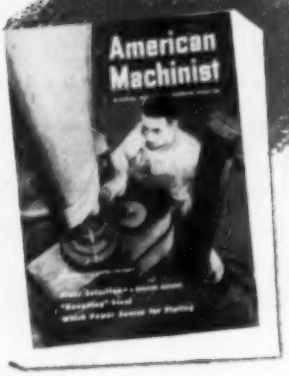


Chips and QUIPS

Snap Gaging . . . A dial indicator snap gage, calibrated in 0.0001-in. steps, is being used to measure shank bearing-race diameter of a Hamilton Standard hollow-steel propeller blade on our cover Kodachrome. The bearing race is part of the retention system for holding a blade in the hub to resist a 100,000-lb centrifugal load. The machine is a Norton vertical cylinder form grinder.

Kneading . . . Remember the vaudeville wheeze about bakers, who sell what they "knead" themselves? Well, Monroe Calculator does the same thing—utilizing a process we'd never heard of, kneading, to produce type characters for business machines. It's the answer for small numbers of numbers; coining is better for large. T. G. Falstrom, tool engineer, gives materials, tools and details on kneading, coining, milling, burring, and broaching operations.

Presses Again . . . Sergius D. Brootzkoos, from his years of experience with mechanical presss, has given us tables and formulas for selecting power presses. Considered are production method, die design, material, and the other factors that should be. It all makes an 8-page Special Report.

Soft Cost Cutting . . . Foremen and supervisors are key men in building a working cost-cutting program. Auren Uris and John Kostmayer outline such a program and implement it . . . You may recall that Brown & Sharpe was very agreeably impressed by foreman suggestions for cutting costs — we described those ideas recently.

Milling Hard Dies . . . Parsons Tool Co., up in Berlin, Conn., regularly carbide-mills hardened steel up to 62 Rockwell, thus being able to repair and remake dies without softening them first. Associate Editor Ashburn went to visit Parsons, got details of tool design and methods . . . We also have from M. E. Frazee of American Wheelabrator, the direct opposite — how to drill holes in rubber quickly and cheaply. Frazee built an indexing-type machine for the job, and tells details herewith.

Machining Ideas . . . John Lund, supt. of mfg. equipt. & processes at the John Deere Waterloo (Iowa) Tractor Works, has given us details on hollow milling and hollow grinding spuds in a special housing. The piece is the major element of a tractor knee-action wheel mount, and is a tough one to machine by any standards. The methods used are tricky too . . . We also show two groups of pictures of unusual machining jobs, one from the NACA Lab at Cleveland, the other from Cummins Engine at Columbus, Ind. The NACA has many 1-of-a-kind problems in producing enlarged and special parts destined to be tested to destruction. Cummins, on the other hand, finds economy in production the key to lowered costs.

This award came from National Safety Council to American Machinist "for exceptional service to safety in 1949."

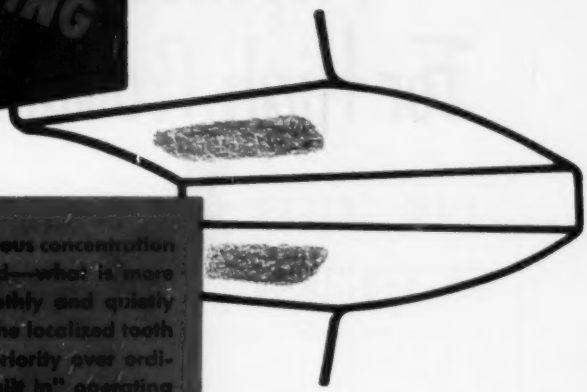
Plating Power . . . Motor-generator or rectifier as a power source? E. G. Schroeder of The Electric Products Company answers that one. He explains how to select and apply the power, offering selection charts that allow for types of process, equipment, and plating conditions.

Coming . . . The Machining of Plastics will be our Special Report for June 26. We'll have stories on how Ford forges rear axles, on Morgan Engineering's replacement program, on automatic stops for dies, on Ford's apprentice program, on press maintenance, and on a variety of other subjects that will interest you.

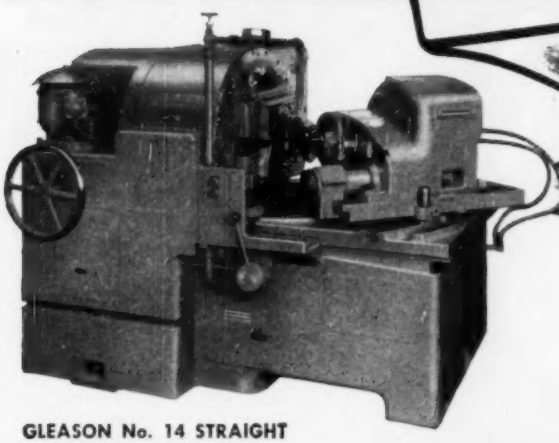
TOOL ENGINEER . . . T. G. Falstrom is a tool engineer who is also a toolmaker—the ideal combination. He served his apprenticeship at Wilmot & Hobs Co. (now Stanley Works) at Bridgeport, Conn., back in 1900-04. He was later a toolmaker at Cadillac, then at Remington Arms. During the years 1907-12, he was in charge of tool and die production at Sloan & Chase Co., Newark, N. J., and 1912-16 tool dept. foreman at Powers Accounting Machine in Brooklyn. During World War I, he supervised tooling for aircraft engines at Wright-Martin Co., Long Island City, then went to Monroe Calculating Machine Co. He was first tool inspector, then tool dept. foreman, but since 1930 has been in charge of tool engineering. He describes tooling and methods for kneading and coining in our current lead article.

CONIFLEX GEARS

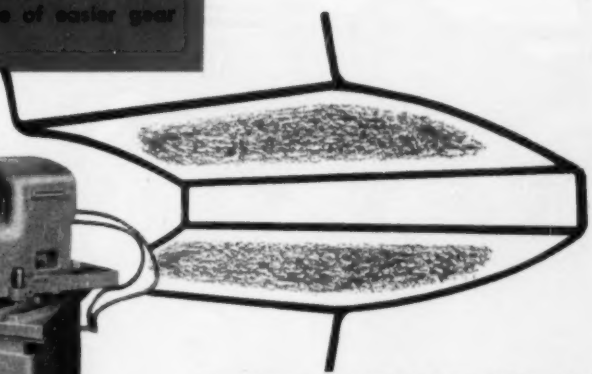
with WIDER OPERATING TOLERANCES



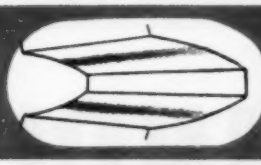
Coniflex* gears have no dangerous concentration of load on the ends of the teeth and—what is more important—Coniflex gears run smoothly and quietly with a safe distribution of load. It is the localized tooth bearing that identifies Coniflex superiority over ordinary straight bevels . . . it is the "built in" operating tolerance that provides safe distribution of load. This "built in" feature, automatically produced during the cutting operation, is your guarantee of easier gear assembly and ideal gear operation.



GLEASON No. 14 STRAIGHT BEVEL GENERATOR



The Gleason No. 14 Straight Bevel Generator is the Coniflex generator for medium size gears. Other models are available for the cutting of gears for small tools and appliances or for large industrial gears. These machines are all equipped with simplified controls to produce a Coniflex bearing during gear manufacture.



Straight bevel gears cut on previous machines usually run under load with a full length bearing or with bearing concentrated dangerously at the ends of the teeth. Coniflex gears eliminate this problem.

*Reg. U. S. Pat. Off.

GLEASON Works
1000 University Avenue
Rochester 3, N. Y., U. S. A.

Builders of Bevel Gear Machinery for Over 85 Years

Replacement Idea For High Production Shops

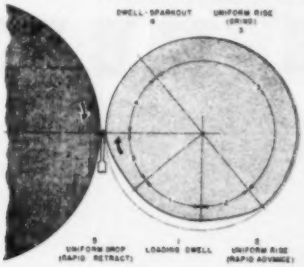
... CAM INFEED CENTERLESS GRINDING ON CINCINNATI FILMATIC

Production—1250 per hour. Centerless grinding the stem of automotive valves by the cam infeed method, on a CINCINNATI FILMATIC No. 2 Centerless Grinder. Automatic loading and ejecting, controlled by Feedmatic Hoppers or a mechanism designed for the job (as illustrated) is required to maintain the production pace set by the machine. The tilting type regulating wheel truing unit is synchronized with the rotation of the wheel.

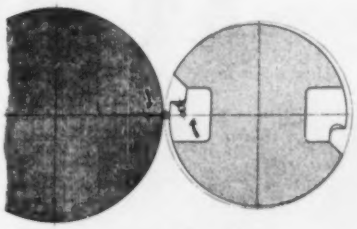
REPLACE WITH A NEW CINCINNATI

CINCIN

PRINCIPLE OF CAM INFEED CENTERLESS GRINDING



Cammed regulating wheel at end of grinding cycle. Work is loaded and ejected at low section of wheel. **Production per minute**—rpm of regulating wheel.



Double cammed regulating wheel, notched for loading and ejecting the work, beginning of grinding cycle. **Production per minute** — 2 x rpm of regulating wheel.

A new method incorporated in a new machine tool lends double attraction to replacement equipment. That's the combination offered by CINCINNATI FILMATIC No.2 Centerless Grinders. The machine, recently greatly improved, can now be equipped with a cammed or notched regulating wheel for automatic infeed grinding. *No slide movement* is required to feed the work to the grinding wheel . . . the regulating wheel takes over this function of the operation. Two drawings above show how this is accomplished. CINCINNATI FILMATIC Cam Infeed Centerless Grinders offer these cost reducing advantages:

1) High rate of production, with practically no expenditure of manual effort

2) Excellent finish, produced by the last fraction of rotation of the wheel; the "dwell" sector

3) Accurate sizing. The "dwell" sector of the wheel removes very little stock; no wheel wear

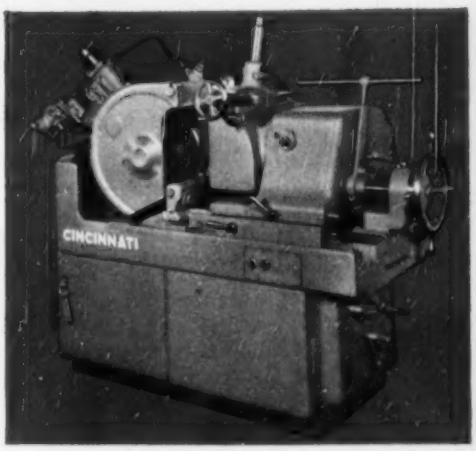
4) No slide movement; no chance for wear or scoring of ways

5) Regulating wheel trued in position to predetermined cam shape

Methods engineers who are concerned with reducing the cost of grinding operations on parts manufactured in large quantities, will find CINCINNATI FILMATIC Cam Infeed Centerless Grinders the answer to their problem. Our application engineers will be glad to assist. Write for literature.

CINCINNATI GRINDERS INCORPORATED

CINCINNATI 9, OHIO



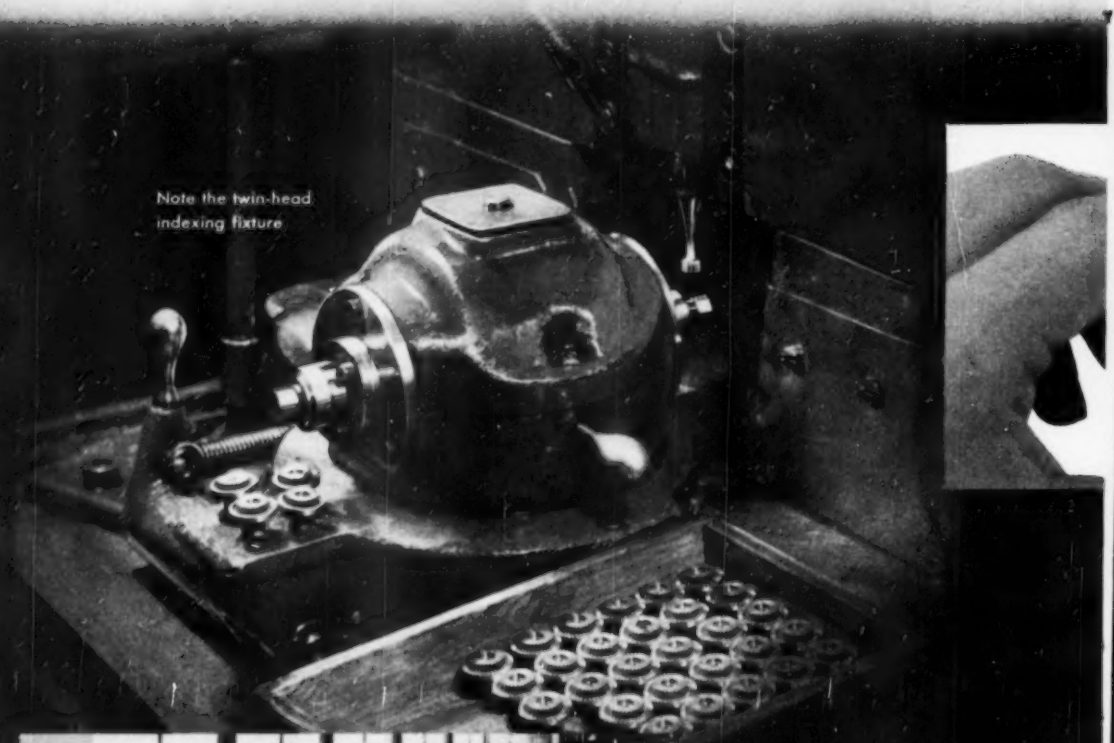
CINCINNATI FILMATIC No. 2 Centerless Grinding Machine. Complete specifications may be obtained by writing for catalog No. G-591.

CINCINNATI FILMATIC

NATI

CENTER TYPE GRINDING MACHINES **CENTERLESS LAPPING MACHINES**
CENTERLESS GRINDING MACHINES **MICRO-CENTRIC GRINDING MACHINES**

AT THE HEART



Note the twin-head indexing fixture

Battery of Fellows Fine-Pitch Gear Shapers in the plant of Supreme Products, Inc., Chicago, Illinois.

GEAR SHAPERS
SHAVING MACHINES
THREAD GENERATORS
CUTTERS AND SHAVING TOOLS
GEAR INSPECTION INSTRUMENTS

PLASTICS MOLDING MACHINES

OF THE Revere

Fellows Fine-Pitch Gear Shapers Hold High Speed Production to Camera Spec. Limits

ONE of the parts in the simple, yet positive, mechanism developed by the Revere Camera Company for synchronizing film movement with movie camera shutter action is a tiny, fine-pitch Involute Face Gear. Assembled with a helical gear, it forms a compact and vital unit in the gear train. The necessary concentricity of the two gears is maintained by cutting both from the same hole, the teeth of the face gear being cut after its assembly with the finished helical. Requirements for accuracy and cost are fulfilled because these face gears can be cut within close limits at a rapid rate on the Fellows 3-Inch Fine-Pitch Gear Shaper.

This machine is particularly suited to the high-production of accurate fine-pitch gears because of its high cutter reciprocating speeds. The teeth in this 36-tooth, 64 pitch, steel face gear are generated with an 18-tooth Fellows cutter, operating at 2000 strokes per minute. The feed per stroke is .0016", and the cutting time, 1 minute 50 seconds. A twin-head indexing fixture reduces handling time to a minimum.

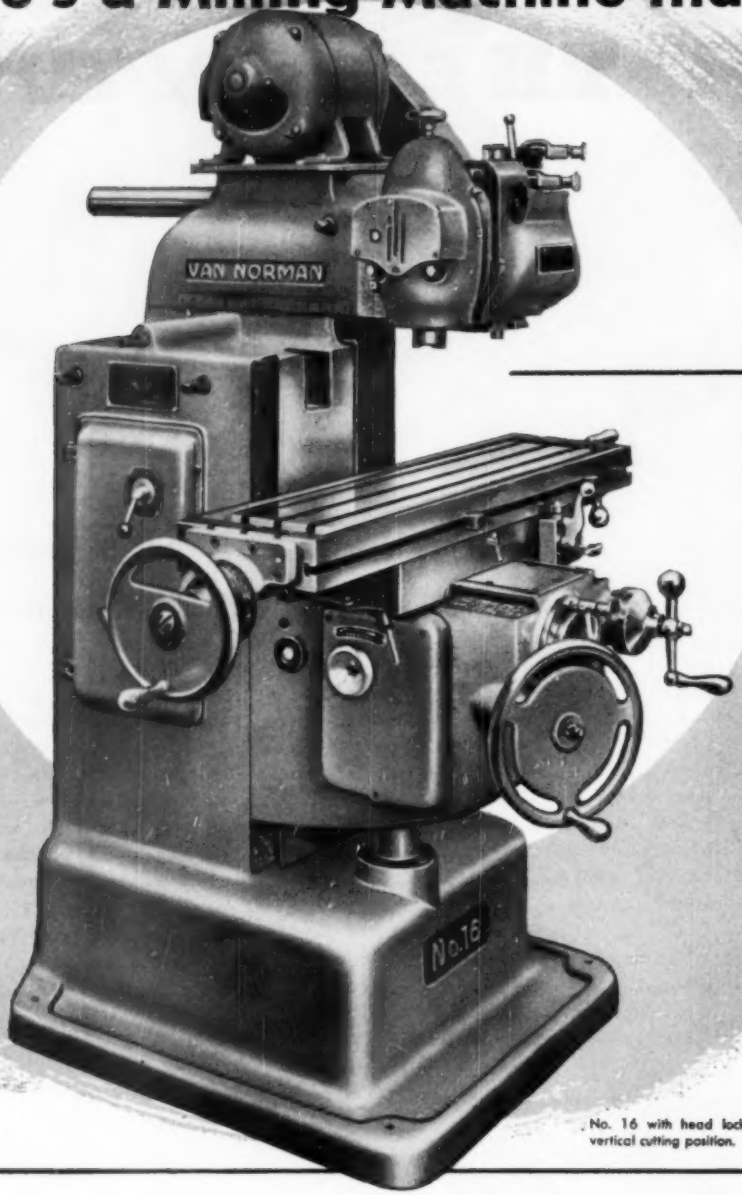
Revere depends on Supreme Products, Inc., gear specialists of Chicago, Ill., for these and other gears cut on their battery of Fine-Pitch Gear Shapers. Two of the machines are equipped for fast-action face gear cutting with the twin-head indexing fixture shown.... Detailed information on Fellows equipment is available from any Fellows office.

*This exactingly precise part and similar parts are used in several models of 8 mm. and 16 mm. Revere Cameras

Fellows

THE FELLOWS GEAR SHAPER COMPANY • Head Office and Export Department, 78 River Street, Springfield, Vermont, U.S.A.
Branch Offices: 616 Fisher Bldg., Detroit 2 • 640 West Town Office Bldg., Chicago 12 • 2206 Empire State Bldg., New York 1.

Here's a Milling Machine that



No. 16 with head locked in vertical cutting position.

Every Feature Points to Ease of Operation — Increased Production — Economy

1. Rugged Adjustable Cutterhead, for Horizontal, Angular, Vertical Milling
2. Built-in Single Lever Electric Operating Control
3. Ease of Operation
4. Movable Ram Scale
5. Spindle Speeds up to 2000 RPM
6. Wide Feed Range
7. Rotary Type Feed Selector
8. Convenient and Accessible Speed Selector
9. One-Shot Metered Lubrication
10. Increased Work Range
11. Easy-to-Read Dials
12. Large Hand Wheels
13. Precision Ground Feed Screws
14. Anti-Friction Bearings
15. Hardened Alloy-Steel Gears
16. Multi-Splined Shafts
17. Large Bar Type Overarm
18. Heavy, Internally Ribbed Column and Base
19. Compact, Rigid, Powerful
20. High Efficiency and Productivity
21. Smooth and Accurate Performance
22. Long Operating Life

Saves Time . . . Reduces Costs —

The VAN NORMAN

No. 16 Ram Type Miller!

The Van Norman No. 16 Miller provides definite contributions to faster, more economical milling in the tool room, pattern shop, die and mold shop, experimental laboratory and repair shop.

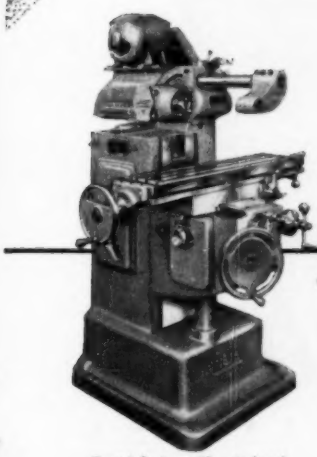
Featuring the adjustable cutterhead and movable ram, it permits horizontal, angular and vertical milling on *one* machine. The combination of adjustable cutterhead and movable ram increases the work range of the miller. Because most milling jobs can be carried through to completion without change in work setup, it eliminates idle operator and machine time by as much as 50%. There's no waiting for single purpose machines . . . no moving work from one type of miller to another.

Versatility Conventional horizontal, vertical as well as angular milling is readily performed by simply positioning the cutterhead in desired position. One machine does the work of three.

Ease of Operation Conveniently grouped controls in front of knee makes operation easy. Power feeds are selected with a quick change feed selector. Large, easy-to-read dials.

Convenience of Electrical Control Built-in electric controls simplify operation. Single lever selector controls spindle, feed and coolant. Push-button, on front of knee, starts and stops motors as pre-selected.

Rugged Construction Rugged base and column, massive cutterhead, large ram and heavy knee, saddle and table assembly provide maximum rigidity and long life accuracy.



Front left view with cutterhead in horizontal position.

Right front view with cutterhead in vertical position.

Van Norman Company

SPRINGFIELD 7, MASSACHUSETTS

"It Pays to Van Normanize"

AUTOMOTIVE LANDIS

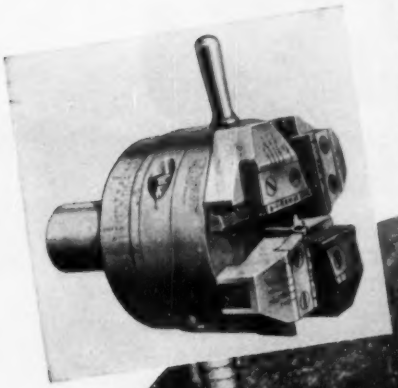
Packard Motor Car Company—Hardened and Ground LANCO Head on LANDMACO Leadscrew Precision Threading Machine cutting a 1" 14 pitch thread 3/8" long on end of a main shaft. Output—150 per hour, floor-to-floor.

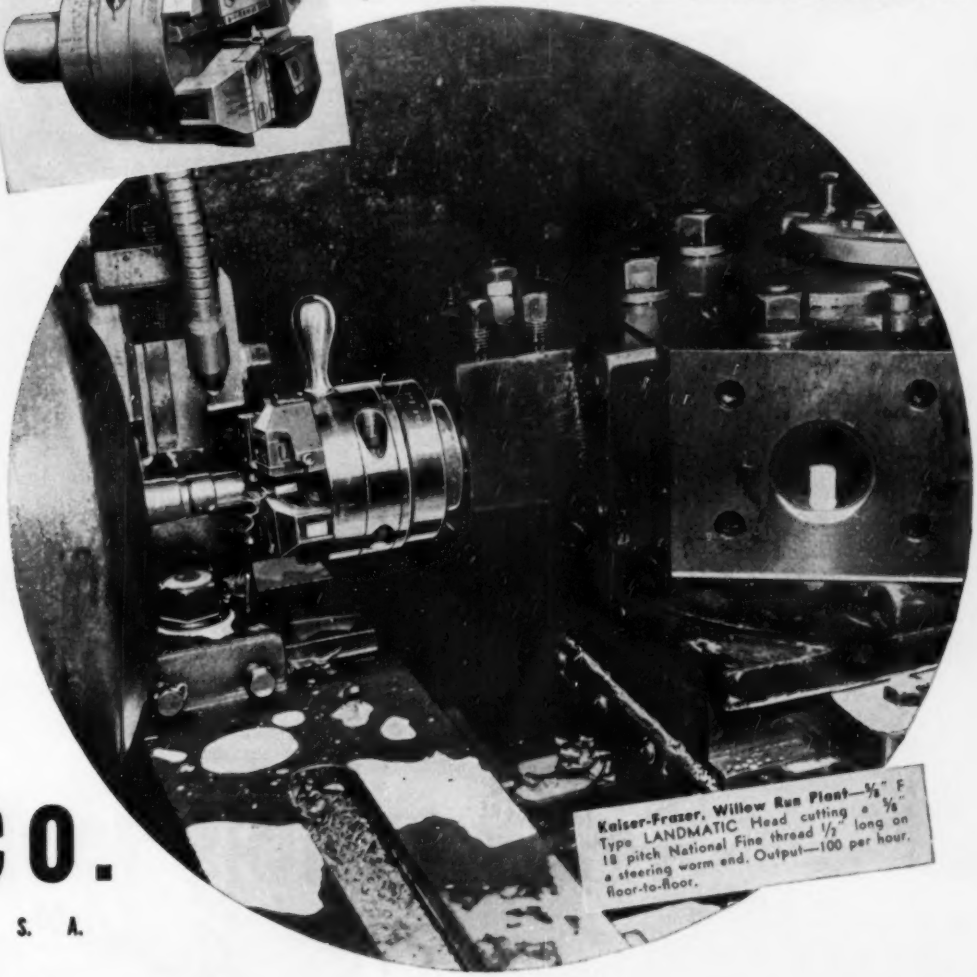
The LANDIS Machine

WAYNESBORO · PENNSYLVANIA

PARTS threaded by DIE HEADS...

Packard and Kaiser-Frazer are two of the many automobile manufacturers using Landis Die Heads to produce threads on automobile parts. In the mass production of parts to be used in a continuous line final assembly, accuracy is as important as high output. Landis Die Heads consistently have been high production tools on a wide variety of operations. At the same time they produce threads to meet the most rigid specifications. The virtual elimination of "down time" on Landis Die Heads is another feature that makes them well adapted to mass production operations. For information, write for Bulletins F-80 & F-90.





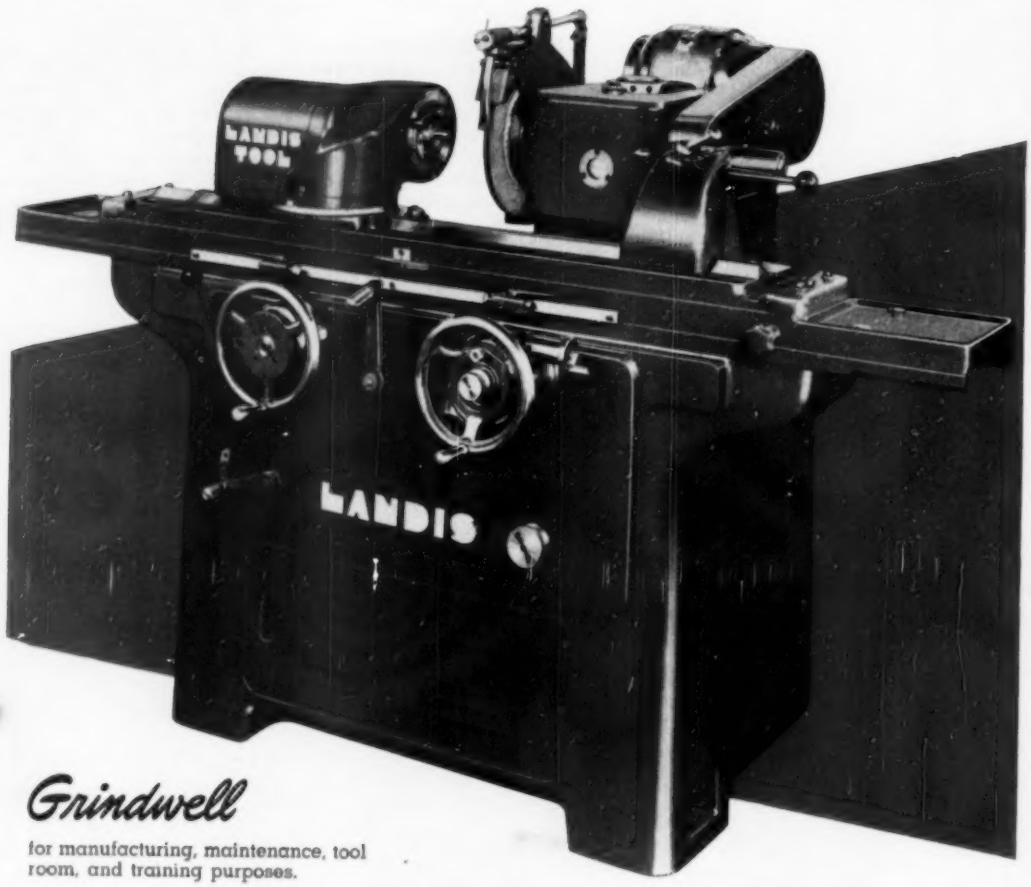
Kaiser-Frazer, Willow Run Plant—⅛" F Type LANDMATIC Head cutting a ⅛" 18 pitch National Fine thread 1½" long on a steering worm end. Output—100 per hour, floor-to-floor.

CO.

U. S. A.

NEW LANDIS TOOL *Grindwell*

a precision universal grinder to fit the small budget



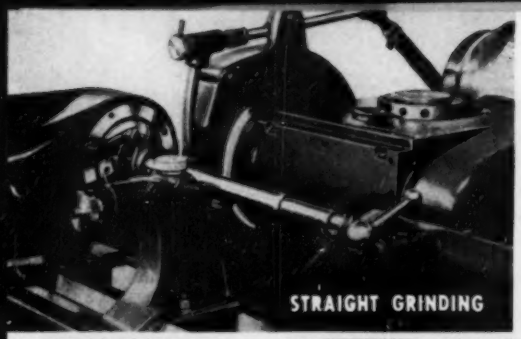
Grindwell

for manufacturing, maintenance, tool room, and training purposes.

107 I

EQUIPPED WITH MICROSPHERE BEARINGS

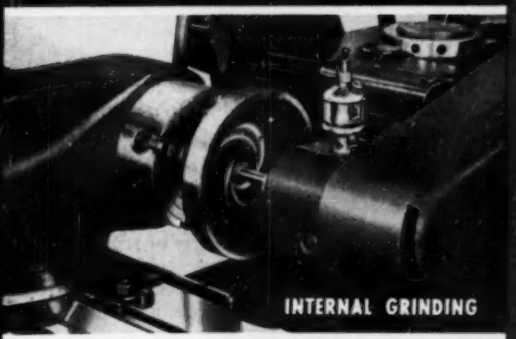
LANDIS TOOL *Precision Grinders*



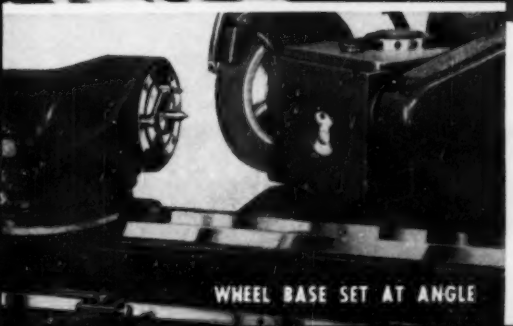
STRAIGHT GRINDING

TAPER GRINDING

FACE GRINDING



INTERNAL GRINDING



WHEEL BASE SET AT ANGLE

Some of the precision grinding operations you can do with

LANDIS TOOL

Grindwell

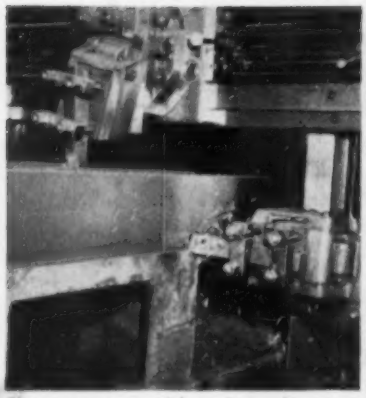
MONEY SAVING FEATURES

for

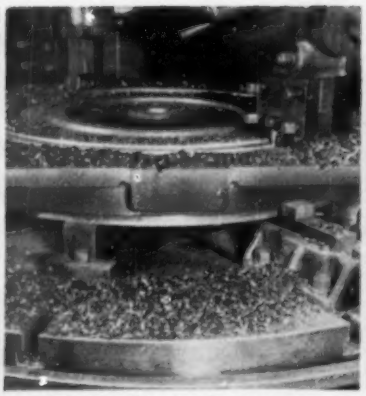
1. Microsphere wheel spindle bearings
2. Variable infinite speed headstock
3. 12" swing - 28" between centers
4. Live and dead spindle headstock
5. 12" diameter grinding wheel
6. Coolant pump and integral coolant reservoir
7. Two speed hand traverse
8. Precision coarse or fine wheel feed
9. Four speed power traverse
10. Swiveling headstock, wheel base and work table

For detailed information, specifications and extra equipment available, request Bulletin 848

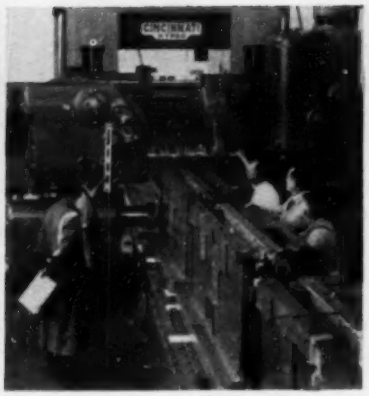
LANDIS TOOL COMPANY, WAYNESBORO, PENNA.



Planers remove metal faster in roughing operations like these by using dependable Davis heavy duty "Clamped-On" tipped carbide cutting tools.



Heavy duty carbide tipped cutters on this vertical boring mill job withstand impact and shock of heavy duty turning, facing and boring.



Arbor mounted gang milling cutters and fixtures that speed work output are designed and furnished as an integral part of Cincinnati Planer's overall "packaged service."

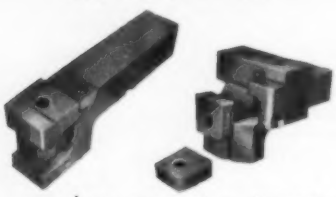
Complete TOOLING SERVICE

Efficient — Job Engineered — Cutting Tools and Machine Accessories Are Now Available with Each New Cincinnati HYPRO Machine

Production men are now able to obtain new Cincinnati Hypro machines complete with cutting tools and machine accessories ready to start any job. It is no longer necessary to divide responsibility between the machine tool manufacturer and the cutting tool manufacturer. A single source for both is available through Davis Boring Tool Div., Giddings & Lewis Machine Tool Co.

Place your order for this completely engineered tooling service with Cincinnati Hypro machines and be assured of faster, easier, overall equipment starting and productivity.

Frog and Switch Tools



Hogging metal in frog and switch planning operations requires these sturdy cutters and cutter holders.

Use Same Tooling Service For Your Present HYPRO Machines

Davis Boring Tool Division offers a wide variety of standard and special carbide tipped planer cutting tools that will increase production on your present machines. Also, depend upon this reliable source for boring tools, milling cutters, adapters, step blocks, stud sets and other time saving tools and accessories.

Combined experience of Cincinnati Planer engineers and Davis tooling engineers is now offered to help solve your machining problems. Ask for this service without obligation.

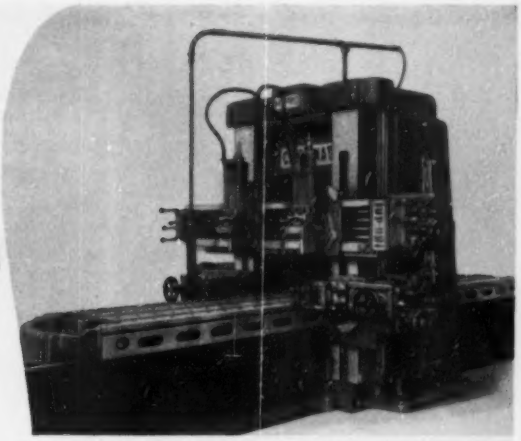
HYPRO

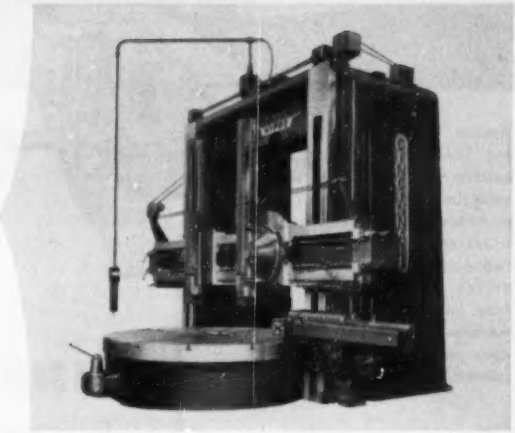
THE CINCINNATI

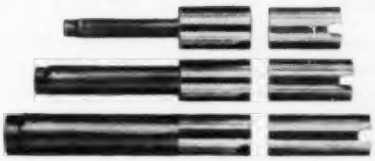
Subsidiary of Giddings & Lewis Machine

FOR HYPRO

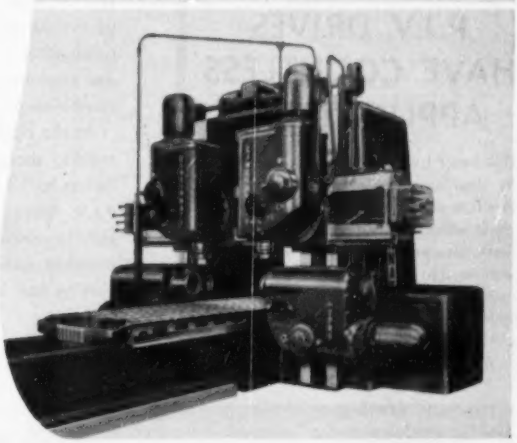
- PLANERS
- VERTICAL BORING AND TURNING MILLS
- PLANER TYPE MILLS

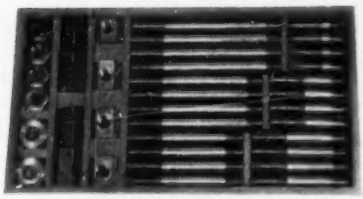






Boring Bars and Adapter Sleeves



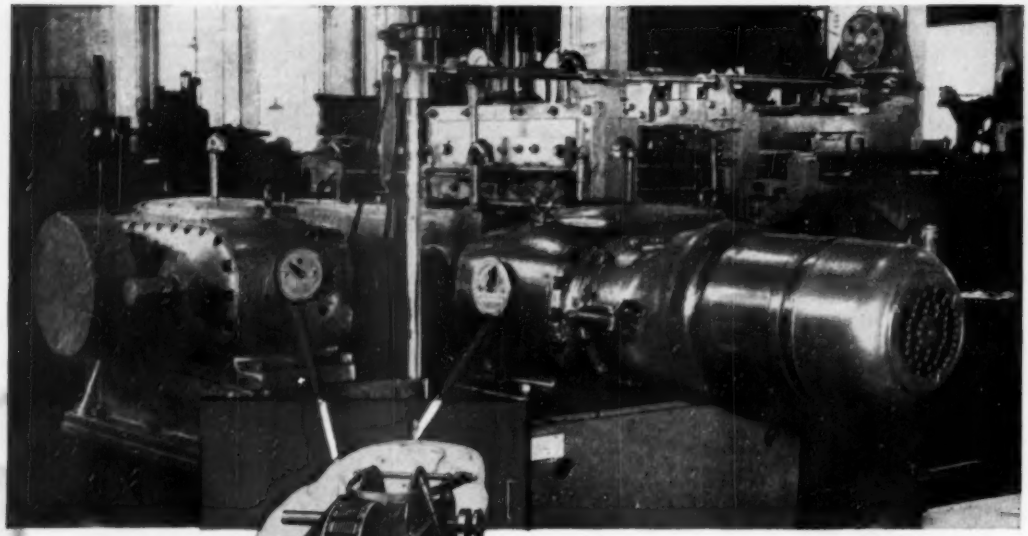


General Purpose Stud Sets

Eliminate hunting time for the right size tee-bolt combination and speed planer set-ups by having a Davis stud set immediately available for instant use.

PLANER COMPANY

Tool Company, FOND DU LAC, WISCONSIN, U.S.A.



Hallden Type 52 Flying Shear used for cutting non-ferrous metals in shearing departments of larger brass mills showing two Link-Belt P.I.V. drives. Connection from hand wheel to machine-operator position provides remote control.

Hallden Flying Shear Cuts Metal Sheets Accurately . . . with

LINK-BELT P.I.V. DRIVES

Top accuracy without reduction of speed or flexibility — it's a have-your-cake-and-eat-it-too problem when you're after efficient volume production in metal shearing. And the problem's easily solved: Hallden engineers simply use Link-Belt P.I.V. variable speed drives in their combination levelers and flying shear machines.

In the Hallden Type 52, shown in this photograph, a continuously moving shear, synchronized with leveler rolls, cuts lengths from 12 inches to 12 feet, to an accuracy of 1/64 of an inch. Two Link-Belt P.I.V. drives vary the length of cut by regulating the speed of the strip in relation to the knife cycle. The P.I.V. drives provide infinitely variable speed regulation without slowing the knife cycle — which cuts as fast as 250 feet per minute.

P.I.V. DRIVES HAVE COUNTLESS APPLICATIONS

Link-Belt P.I.V. will drive any machine at its ideal speed for maximum production. Positive power transmission through a chain which automatically forms its own teeth, assures transmission of every r.p.m. with no slip. Output speed is accurately controllable while machine is running with speed ratio remaining fixed under constant loading until change is desired.

Available in eight types, up to 25 h.p.

LINK-BELT COMPANY

Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Johannesburg. Offices, Factory Branch Stores and Distributors in Principal Cities.

Wherever wide-range, accurate, stepless control is essential for efficient operation of individual machines at optimum speeds . . . INDUSTRY USES

11,600

LINK-BELT

P.I.V. Variable Speed Drive

"no more GAMBLING on tool steel selection"

[½ actual size; Selector is in 3 colors]

Since the first announcement, hundreds of tool steel users have received their CRUCIBLE TOOL STEEL SELECTORS. The comments received indicate that this handy method of *picking the right tool steel right from the start* is going over big.

"Handiest selector I've ever seen"

"No more gambling on tool steel selection"

"You're right, the application should dictate the choice of the tool steel" . . . and many, many more favorable comments.

You'll want your CRUCIBLE TOOL STEEL SELECTOR. It uses the only logical method of tool steel selection—begin with the application to pick the right steel! And the answer you get with one turn of the Selector dial will prove satisfactory in every case, for the CRUCIBLE TOOL STEEL SELECTOR covers 22 tool steels which fit 98% of all Tool Steel applications. ALL the tool steels on the Selector are in Warehouse Stock . . . that means when you get the answer, you can get the steel . . . fast!

Write for your Selector today! We want you to have it, because we know you've never seen anything that approaches your tool steel problems so simply and logically. Just fill out the coupon and mail. Act now! CRUCIBLE STEEL COMPANY OF AMERICA, Chrysler Building, New York 17, N. Y.

Here's how it works:

To use the Selector, all you need know is the characteristics that come with the job: type and condition of material to be worked, the number of pieces to be produced, the method of working, and the condition of the equipment to be used.

FOUR STEPS—and you've got the right answer!

1. Move arrow to major class covering application
2. Select sub-group which best fits application
3. Note major tool characteristics (under arrow) and other characteristics in cut-outs for each grade in sub-group
4. Select tool steel indicated

That's all there is to it!

Here's an example:

Application—Deep drawing die for steel

Major Class—Metal Forming—Cold

Sub-Group—Special Purpose

Tool Characteristics—Wear Resistance

Tool Steel—Airdi 150

One turn of the dial does it!

And you're sure you're right!!

Crucible Steel Company of America
Dept. A, Chrysler Building
New York 17, N. Y.

Gentlemen:

Sure! I want my CRUCIBLE TOOL STEEL SELECTOR!

Name_____ Title_____

Company_____

Street_____

City_____ State_____

CRUCIBLE first name in special purpose steels

TOOL STEELS

fifty years of Fine *steelmaking*

Branch Offices and Warehouses: ATLANTA • BALTIMORE • BOSTON • BUFFALO • CHARLOTTE • CHICAGO • CINCINNATI • CLEVELAND • DENVER • DETROIT HOUSTON, TEXAS • INDIANAPOLIS • LOS ANGELES • MILWAUKEE • NEWARK • NEW HAVEN • NEW YORK • PHILADELPHIA • PITTSBURGH • PROVIDENCE ROCKFORD • SAN FRANCISCO • SEATTLE • SPRINGFIELD, MASS. • ST. LOUIS • SYRACUSE • TORONTO, ONT. • WASHINGTON, D. C.

A REAL COST CUTTER . . .
The NORTON Type CTU

Production Conveniences

• Feed Rate Controls are all conveniently set in front of machine.

Precise Truing and Grinding Speeds. Proper speeds set from first piece on job. Later replacement brings one or the other thereafter — no search or try.

Automatic Wheel Feed at table reversals—with automatic re-set after grinding to size.

Table Dwell Controls, both right hand and left hand, are adjustable separately and located near-at-hand directly in front of operating position.

Positive-touch Work Stopping Levers enable work to be stopped at any time whether work rotation is being automatically or manually governed.

YES—the ability of Norton 6'' and 10'' Type CTU grinders to bring about important savings in costs, is being *proved* in plant after plant. This is because their many operating and maintenance conveniences and their many exclusive design features make savings possible all along the way.

For instance, in the production of motorshafts a prominent producer has achieved a saving of 38% with the Type CTU.

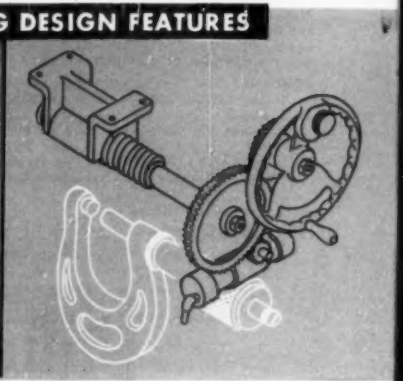
In another case, a transmission manufacturer has averaged savings of 20 to 25%.

Again, an automobile maker has experienced substantial savings on an axle shaft grinding operation. And in addition, a grinding foreman in this plant has remarked, "This is the best grinder that has ever been produced. It runs day and night and never a sign of trouble."

There's a Norton machine engineer or a Norton machine distributor near you—let him show you just how the Norton CTU can save money on *your* cylindrical grinding jobs.

M 588

TWO OUTSTANDING DESIGN FEATURES

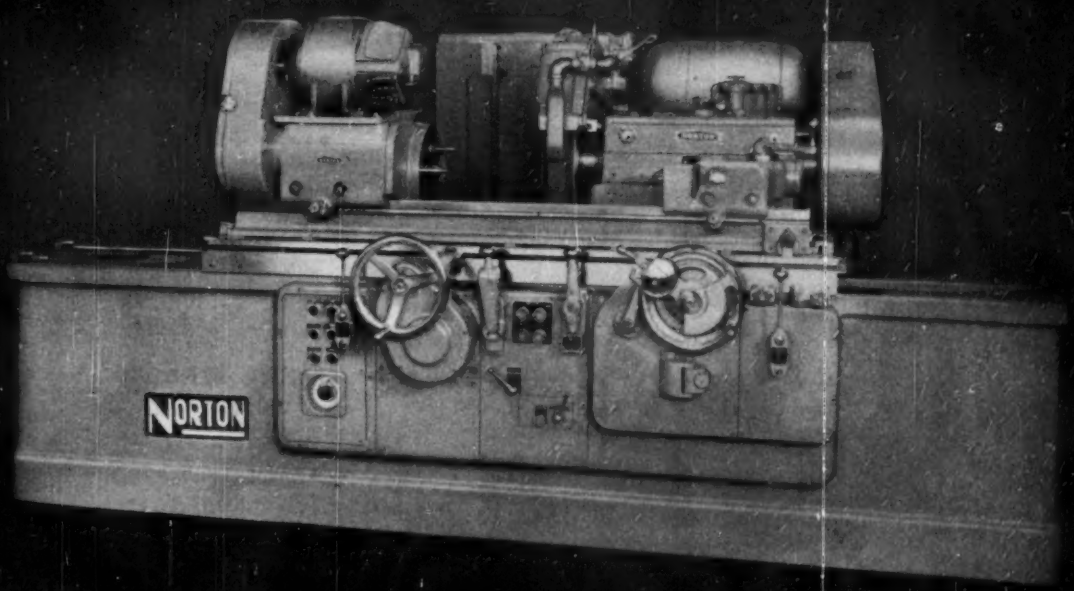


THE NORTON WHEEL SPINDLE UNIT—over 50% of spindle body supported in two super-duty size, hard bronze bearings. Spindle stays on its fixed center line—no shifting possible. Flood lubrication is automatic, filtered, self-contained within wheel slide.

THE NORTON MICROMETRIC REVOLVING FEED SCREW MECHANISM provides complete metal-to-metal contact during grinding feed portion of cycle—a feature that insures prolonged accuracy.

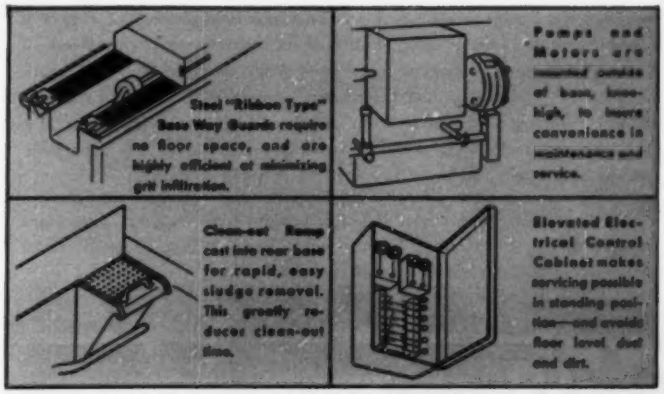
You Cannot Afford to Operate without These Cost-cutting Features!

. . . DEFINITELY PROVED
Cylindrical Grinder



NORTON 10" - 16" TYPE CTU
SEMIAUTOMATIC CYLINDRICAL GRINDER

Maintenance Conveniences



Steel "Ribbon Type" Base Way Guards require no floor space, and are highly efficient at minimizing grit infiltration.

Pumps and Motors are mounted outside of base, knee-high, to insure convenience in maintenance and service.

Clean-out Ramp cast into rear base for rapid, easy sludge removal. This greatly reduces clean-out time.

Elevated Electrical Control Cabinet makes servicing possible in standing position—and avoids floor level dust and dirt.

These features of the new CTUs and many more are illustrated and described in detail in four new catalogs. No. 157-2 covers the 6" plain, No. 1488-1 the 6" semiautomatic, No. 166-2 the 10" plain and No. 1787-1 the 10" semiautomatic. Write for any or all—no obligation.

NORTON GRINDERS

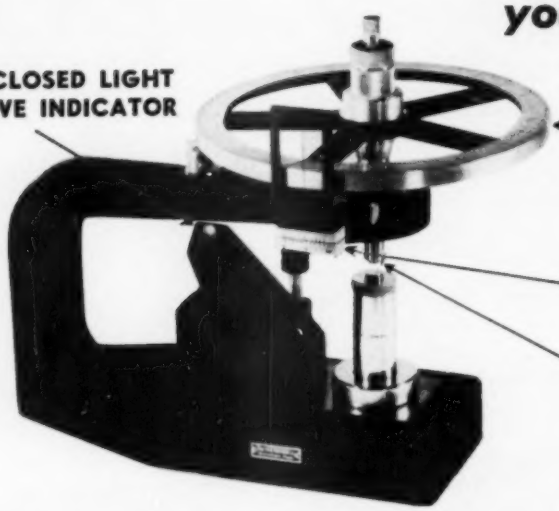
NORTON COMPANY, WORCESTER 6, MASS. - New York - Chicago - Detroit - Cleveland - Hartford - Distributors in All Principal Cities

THE NEW

Van Keuren

0 to 3" LIGHT WAVE MICROMETER

will improve your product . . .



CATALOG AND HANDBOOK No. 34

This 208-page volume represents 2 years research sponsored by the Van Keuren Co.

It presents for the first time in history a simple and exact method of measuring screws and worms with wires.

It tells how to measure gears, splines and involute serrations. It is an accepted reference book for measuring problems and methods.

Copies free upon request. ●

THE Van Keuren Light Wave Micrometer is an instrument of exceptional merit, proven over a period of 15 years. It has enabled hundreds of High School boys and girls to produce and inspect parts to "Hundred Thousandths" of an inch.

The New 0 to 3" Light Wave Micrometer has a ½" diameter, 40 threads per inch micrometer screw, which can be made with greater accuracy and which has 3 times the wearing surface of an ordinary micrometer screw. It has an 8" diameter micrometer wheel, with .0001" graduations 1/10" apart. It has a non parallax, vernier index which enables readings to be made to .00001". It has an index lock. It has carboloy tipped anvil and spindle. It is a sturdy, yet sensitive instrument which weighs 17 pounds. It is a portable measuring machine, built for "Sustained Accuracy."

The Light Wave Micrometer is not a comparator. No gage blocks are needed and no errors creep in from worn blocks. It is a direct source of dependable precision—fast, accurate and profitable.

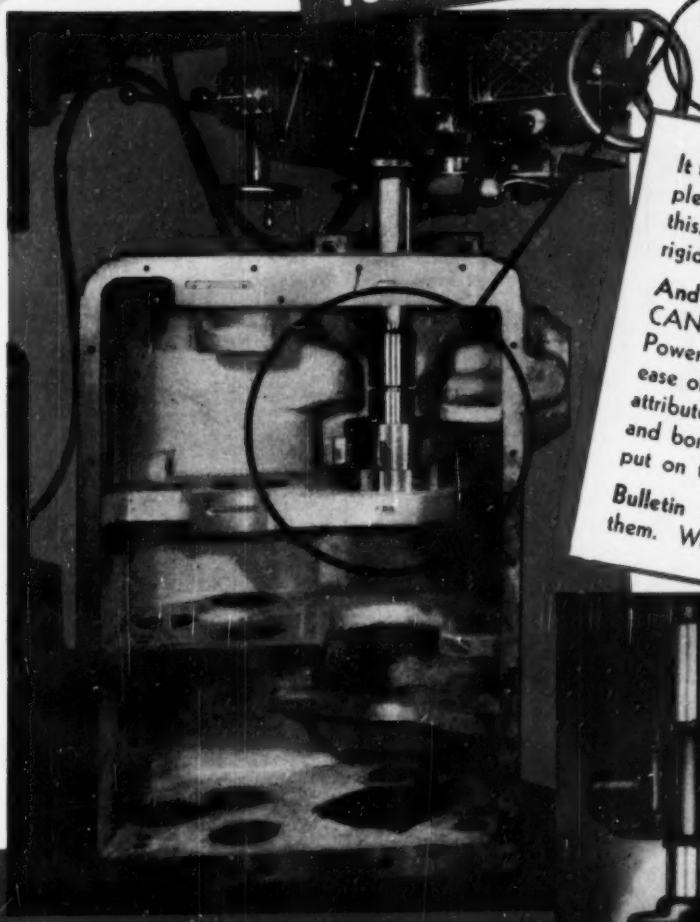
THE Van Keuren CO., 173 WALTHAM STREET, WATERTOWN, MASS.

31st YEAR

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Plug Gages • Carboloy Measuring Wires

A GOOD SPINDLE

FOR GOOD BORING AND TAPPING . . .

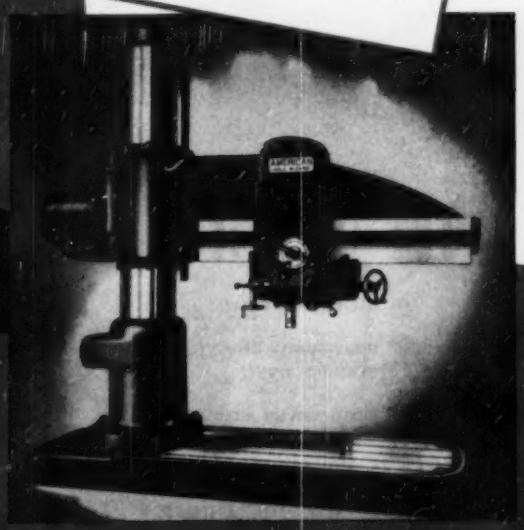


Here's a 10" tapping job on a 5-foot "AMERICAN" Hole Wizard Radial

It takes a sturdy, rigid machine with plenty of power to do work like this. Especially does it require a rigid and smooth-acting spindle.

And that's exactly what "AMERICAN" Hole Wizards are noted for. Power—rigidity—convenience and ease of control are "AMERICAN" attributes that cut drilling, tapping and boring costs wherever they are put on the job.

Bulletin No. 327 tells all about them. Want one?

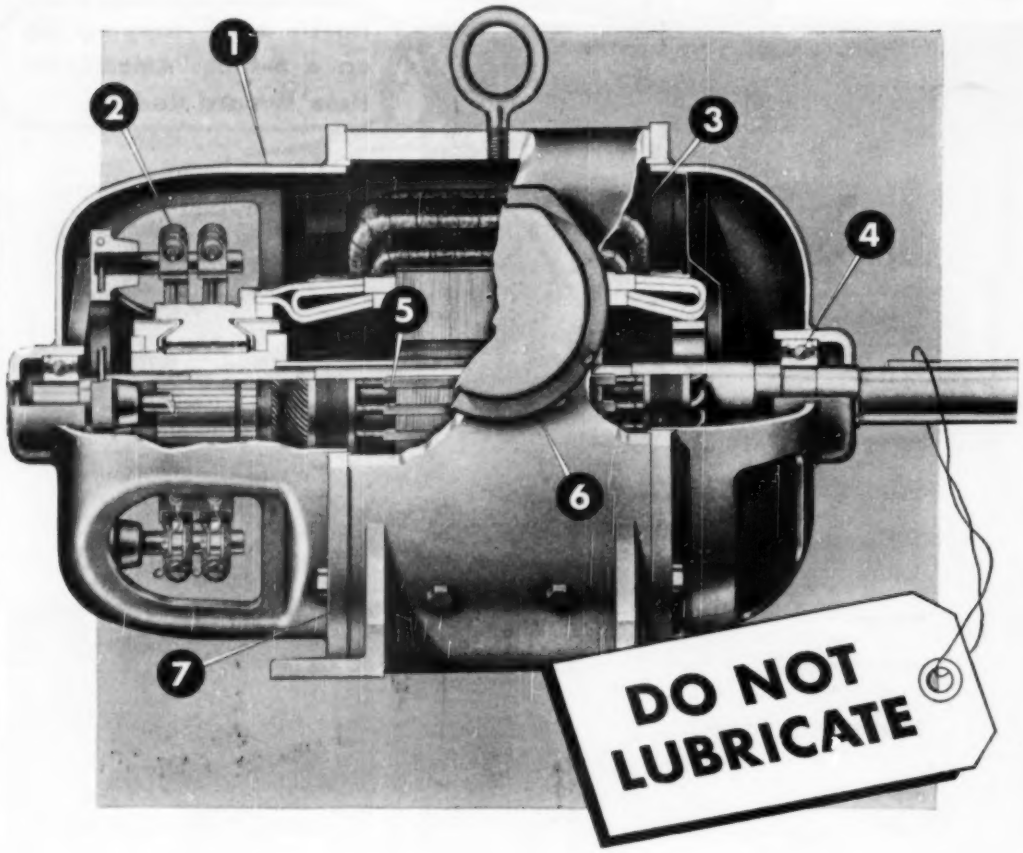


THE AMERICAN TOOL WORKS CO. **Cincinnati, Ohio U.S.A.**

Lathes and Radial Drills

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



1. ALL-STEEL BRACKETS
2. INDIVIDUALLY REMOVED CAST BRASS BRUSHHOLDERS
3. SHELL-WOUND FIELD COILS
4. DOUBLE-SEALED PRE-LUBRICATED BALL BEARINGS
5. HEAVY-DUTY PRESHAPED ARMATURE COILS
6. STEEL-GASKETED CONDUIT BOX
7. ROLLED-STEEL FRAME

If you figure LIFE-COSTS... you'll figure LIFE-LINE

SK DEPENDABILITY
Wrapped in Steel
in the NEW Life-Line D-C MOTOR

Thirty-nine years at hard labor—in steel mills . . . in mines . . . in a thousand and one applications—have proved the dependability of the type SK d-c motor. Now, new dependability has been added—new motor stamina . . . new freedom from maintenance . . . new value for d-c motor users.

MAXIMUM STRENGTH AND RIGIDITY—Heavy steel end brackets and rolled-steel frame stand up to the shocking, jarring blows so often encountered in rugged d-c service.

SIMPLIFIED SERVICING—Readily accessible through spacious opening in front bracket, brushholders may be removed individually. Armature coils, wound from Tufvar wire and treated in Thermoset varnish assure long life . . . reduce trouble from shorts and grounds. Double-sealed pre-lubricated bearings (proved in over half a million motors) put an end to greasing problems.

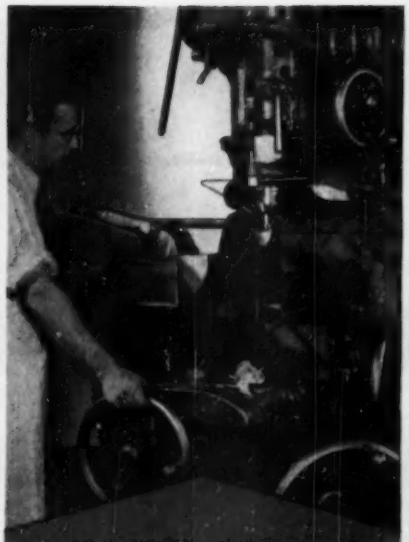
INDIVIDUAL FIELD COIL UNITS—One coil may be replaced without expense of replacing all . . . or discarding pole piece. Just slip the new coil in place . . . save repair costs.

These are a few highlights of the new, all-steel Life-Line type SK d-c motor. Get the complete facts on series, shunt, or compound motors . . . frames 203-365 . . . in 1 to 30 hp ratings. Contact your local Westinghouse representative. Ask for a copy of "D-C Motor" Booklet B-4595, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-21549

Westinghouse
Life-Line
D-C Motors

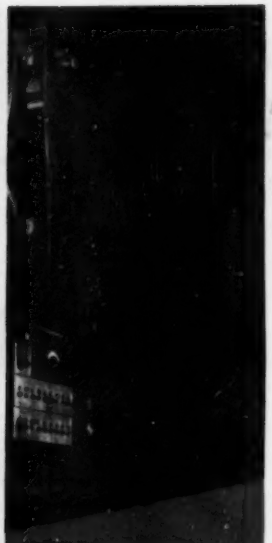
P & W JIG GRINDER

Locates and grinds to "tenth" accuracy on a casting die adapter. This key machine locates its work with end measures, inside micrometers, dial indicators . . . grinds at high speeds . . . then checks its own work.



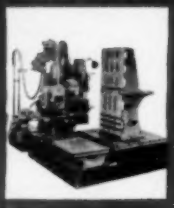
P & W DIE SINKER

Universal model permits changeover from straight cutting to cherrying using *standard* die sinking *cutters*. Machines die cavities accurately at low-cost-per-die. Two Universal models and two Plain models available.



P & W KELLER

Reproducing a 3-dimensional partial



THESE TOOLS OF PRECISION

ARE UNIQUELY QUALIFIED TO PRODUCE

A BETTER DIE—A BETTER MOLD

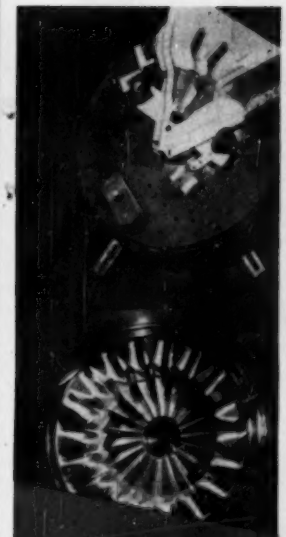
at a better profit

PRATT & WHITNEY

Division Niles-Bement-Pond Company

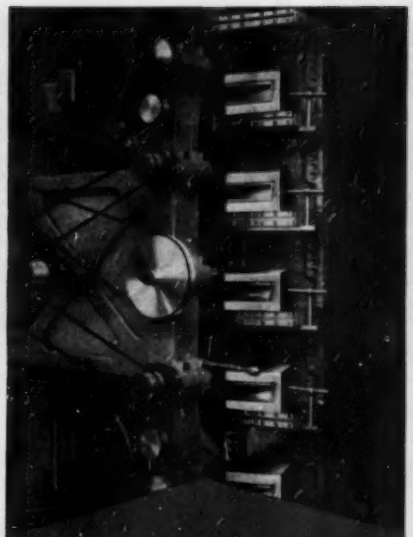
WEST HARTFORD 1, CONNECTICUT

"There's no better paying

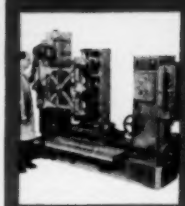


MACHINE

model to produce perfect die for jet engine impeller. Tracer-controlled milling at its best. There's a KELLER for every need, type BG-2 at left.



P & W AUTOMATIC DUPLICATING MACHINE



Accurately reproducing jet engine blade forging dies, 4 at a time from master die. Automatic, precise, economical duplication. Machine available with 1, 2 or 4 cutting spindles.

KELLERFLEX

FLEXIBLE SHAFT MACHINES

KELLERFLEX makes craftsmen — the "mechanical muscle" that puts more power in good hands for easier, faster, truer shaping and finishing by better burring, filing, sanding, grinding, wire brushing and polishing.

There's no secret to the success of these *TOOLS OF PRECISION*. It's simply a matter of transferring their basic accuracy to the job they produce . . . be it small or large.

Their accuracy starts right at the engineering stage, when characteristic P&W precision is designed into machines that must be fundamentally correct in order to achieve fast, accurate, economical production.

Master craftsmen produce them with accuracy in mind in every step of their manufacture . . . applying Pratt & Whitney standards of precision to every element of every machine — from the metal itself all the way through to assembly and inspection. Profits stem from these P&W Tools of Precision.

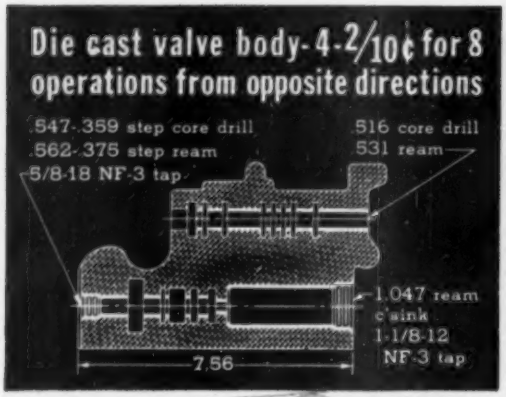
P & W CUTTING TOOLS
are also *Tools of Precision*

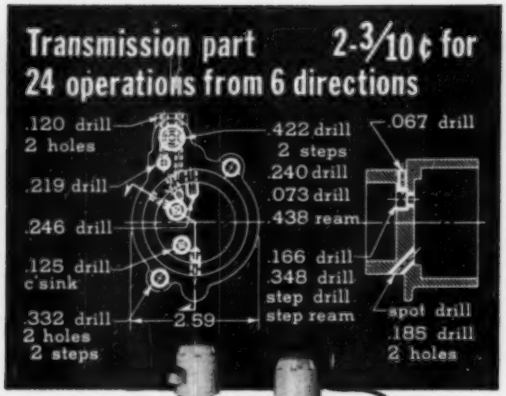
With "Accuracy Headquarters" as your single source of supply, you get unified responsibility. These better Machines produce better work and more of it with precision Cutting Tools made by Pratt & Whitney: Milling Cutters . . . Die Sinking and Cherrying Cutters . . . Drills . . . Reamers . . . Keller Cutters and Tracer Points . . . and a full line of Carbide Burs, including the new Di-Bur specially suited to die steels.

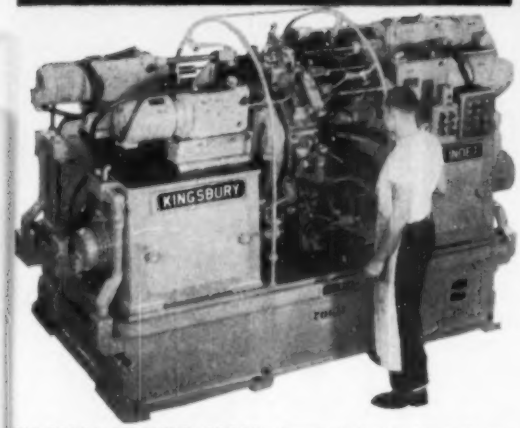
Besides the Machines illustrated, P&W Jig Borers, P&W Vertical Shapers and P&W Vertical Surface Grinders rate high as key equipment for the die and mold shop.

Informative, well-illustrated Bulletins on all machines are available. Write today for the ones you want.

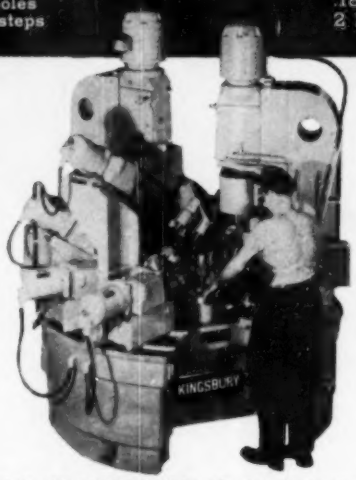
investment than the Right Tools for the Job"


Die cast valve body- 4-2/10¢ for 8 operations from opposite directions
.547-.359 step core drill
.562-.375 step ream
5/8-18 NF-3 tap
.516 core drill
.531 ream
1.047 ream c'sink 1-1/8-12 NF-3 tap
7.56





200 PARTS AN HOUR GROSS. Opposed horizontal units on this vertical indexing machine work on opposite faces of the part in the same chucking—three units on the left face and five on the right. Bushings guide all of the tools but the taps.



330 PARTS AN HOUR GROSS. On this horizontal indexing machine ten units work from six directions: vertical, angular, angular across the index table and horizontal—on the radial line and at two angles to it. Bushings guide 15 of the tools.

Costs go down with many

Automatic drilling and tapping machines work from several directions to close tolerances at low cost

Dear Sir:

Look at the number of operations per hour on these parts:

Die cast valve bodies	1280
Transmission parts	6336
Typewriter parts	2688
Throttle bodies	5440

And here are the average costs for man and machine per operation:

Die cast valve bodies	53/100¢
Transmission parts	10/100¢
Typewriter parts	14/100¢
Throttle bodies	19/100¢

We assumed three things: 1) 80% efficiency. 2) Each man's wage rate would equal the national average for such work. 3) The entire cost of each machine and tooling would be paid for after only 6000 hours of operation, a fraction of its useful life. No power or overhead.

You would probably figure these costs another way. But you would get the same result: Kingsburys give low unit costs on high production work.

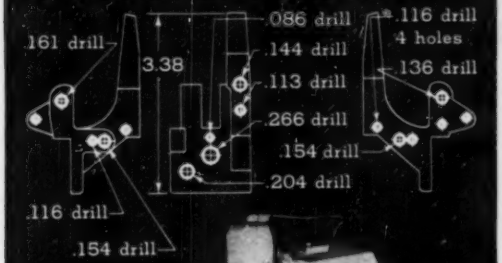
Why unit costs are low

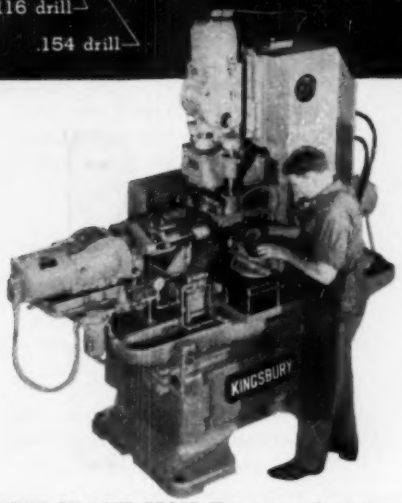
You need several general-purpose machines and several operators to keep up with one Kingsbury and one operator. That costs more, even if your machines would otherwise be idle. You pay for more operators, more supervision, more handling and more space. If your production is high enough to keep a Kingsbury busy most of the time, it would pay for itself in a matter of months.

A visitor argues a point

Somebody once disputed our claim of one person to a machine. He said, "I just saw a line of Kingsburys — big ones with 25 units apiece. All of them needed two chaps. One chap operated it. Another chap had to work full time hauling away chips." We said he exaggerated and stuck to our claim.

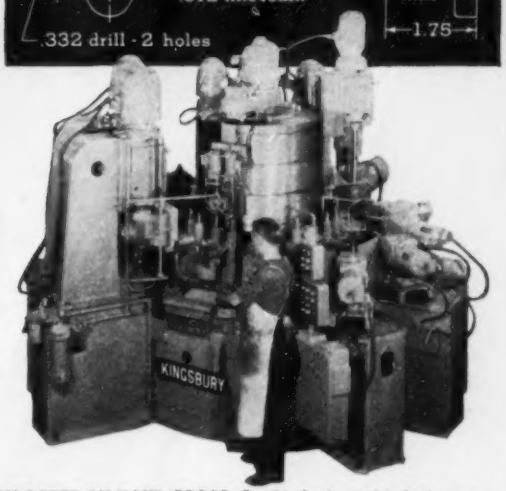
Typewriter part **1-9/10¢ for 14 operations from 3 directions**





240 PARTS AN HOUR GROSS. The operator loads two parts in the fixture. Three units drill five holes in one part and nine in the other part. The operator indexes the fixture 180° and the units complete both parts. Bushings guide all 14 of the drills.

Throttle body **3-2/10¢ for 17 operations from 5 directions**



400 PARTS AN HOUR GROSS. On this horizontal indexing machine with central column, 13 units work from five directions: vertical, underneath, horizontal, horizontal on the backstroke (milling) and horizontal off radial line. Bushings guide 9 tools.

operations per man-hour

Work from many directions

Each setup above uses a different basic machine. With each type, independent units can operate from different directions in the same chucking of the work. Because we can choose from so many basic machines and units, we can find efficient setups for many jobs.

Close tolerances

Bushings locate tools accurately. Guide bushings are in the fixtures or in plates that pilot to the fixtures. In the four Kingsburys shown, bushings guide 44 of the 63 tools. They do not guide taps, milling cutters or tools that locate from other operations.

Operations are in exact relationship. Each Kingsbury completes many operations in one chucking of the work.

Machining is uniform. Units with automatic cycles and cam feeds perform all operations.

Let's talk about your job

A specific proposal will show you if a Kingsbury can save you money. Just send a print of a high production part to our Mr. L. A. Carll. Tell him the operations and hourly output you need. Or ask him for free bulletins that show 53 setups.

Sincerely,
Kingsbury Machine Tool Corp.
35 Laurel Street, Keene, N. H.

P.S. Don't get the idea we do only *tough* jobs. We can save you money with simple setups too. Just ask us.

KINGSBURY
AUTOMATIC DRILLING & TAPPING MACHINES
for Low-Cost High Production

HIGH PRODUCTION with WINTER PIPE TAPS

Leak-proof pipe joints on a production basis in all types of metals require pipe taps that combine precision with high performance.

Winter "Balanced Action" Pipe Taps are the result of study and long experience in this field. Regular styles, Interrupted Thread, and Dry Seal styles are all available.

Special Pipe Taps for stainless steel and other difficult materials, as well as taps for unusual applications, are designed to your requirements by experienced Winter Tap Engineers.

Winter also makes and stocks Hand, Machine Screw, Chip Driver, Pulley, and Nut Taps, and many other types and sizes of threading tools.

ALWAYS AT YOUR SERVICE

YOUR LOCAL DISTRIBUTOR carries a complete stock of WINTER Taps on his shelves—as close to your tapping problems as the telephone on your desk.

WINTER

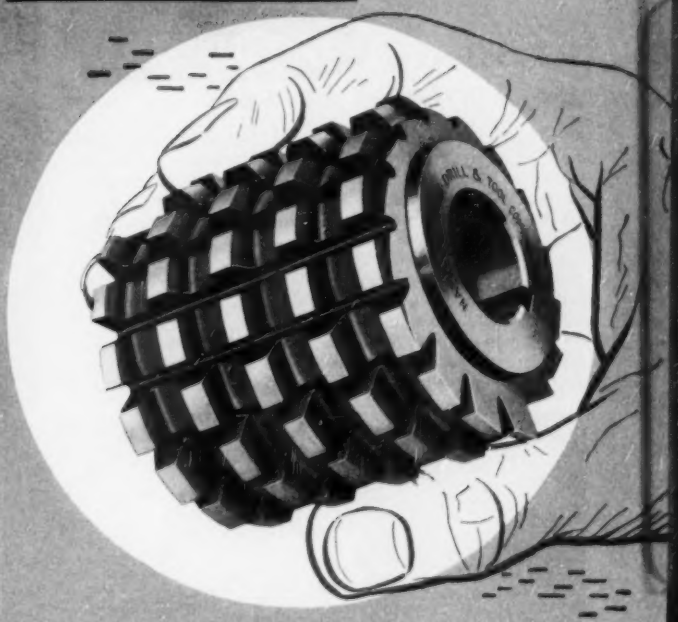
WINTER BROTHERS COMPANY • Division of the National Twist Drill and Tool Company, Rochester, Michigan, U. S. A. Distributors in Principal Cities • Branches in New York, Detroit, Chicago, San Francisco

ACCURACY and LONG TOOL LIFE with NATIONAL HOBS

For continuous cutting of gear teeth, splines, and other symmetrical projections, the hobbing process is recognized as a most efficient method. However, both work accuracy and hob life depend on the quality and precision of the hob itself.

National Hobs have the inbuilt qualities born of sound engineering, exact processing, and long field experience. Furthermore, National hob specialists are always ready to assist you on new or troublesome jobs.

Other National products are Twist Drills, Reamers, Counterbores, Milling Cutters, End Mills, and Special Tools.



"CALL YOUR DISTRIBUTOR"— it is NATIONAL'S firm belief, based on long experience, that the local industrial distributor is the one best source for all staple industrial needs— including NATIONAL Metal Cutting Tools.

NATIONAL TWIST DRILL & TOOL ROCHESTER, MICH. U.S.A.

National

NATIONAL TWIST DRILL AND TOOL COMPANY •
Rochester, Michigan, U. S. A. Distributors in Principal Cities
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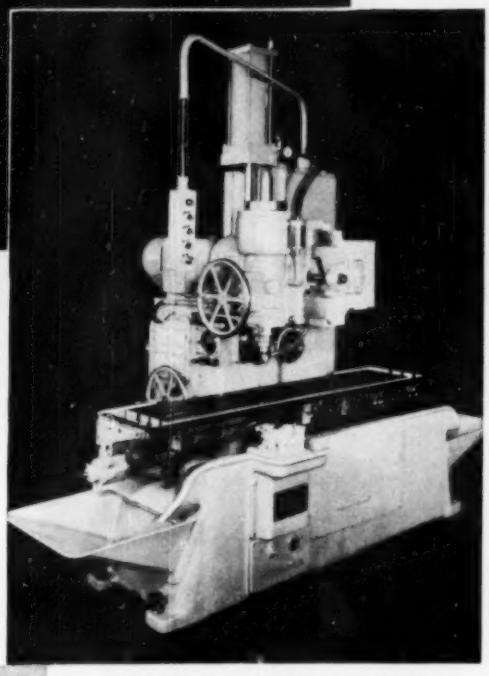
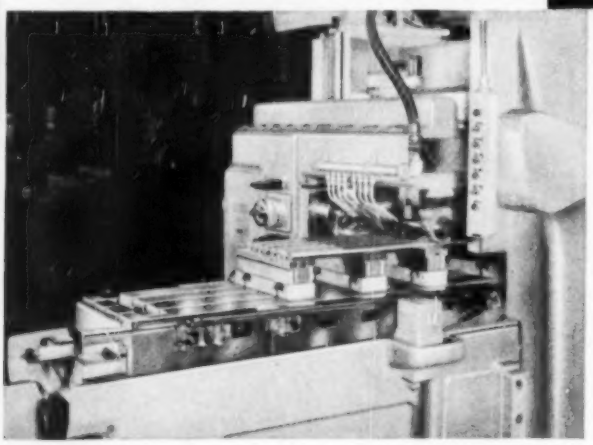
Milling Keyways?

Here's How You'll Save Time and Cut Costs With SUNDSTRAND *"Engineered Production"*



***For Instance,* IF YOU MILL *Many Different Keyways . . .* ➡**

Here's a general purpose keyway miller that will handle a lot of different sizes of shafts and keyways. It has a horizontal spindle for "gashing" and a vertical spindle for end milling. Both are adjustable vertically by handwheel with micrometer dial for accurate setting. In addition, the vertical spindle has cross adjustment, and the horizontal spindle has endwise quill adjustment. The table can be controlled by hand for single keyway milling or automatically by table dogs for production milling. Machine illustrated has 14″ wide table and 48″ feed stroke, but other sizes are available on request. Machine can also be used for other milling operations such as face milling of two surfaces at right angles.



⬅ *Mill Straight or Intermittent Keyways On A Production Basis . . .*

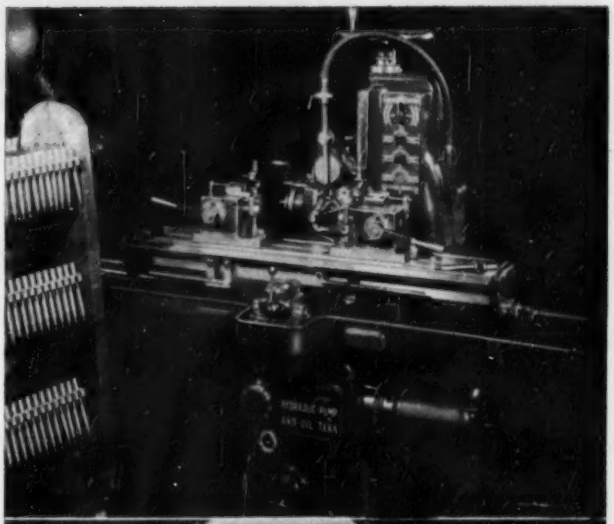
This Sundstrand Simplex Rigidmil is equipped with a vertical feed attachment, a special overarm and overarm support bracket, and Sundstrand magnetic work-holding fixture. It mills multiple or intermittent keyways at various depths in tractor shafts. The vertical feed attachment with the necessary controls gives four automatic head movements in combination with skip table feeds. By combining the head and table movements, as many as four keyways of different depths are milled in one automatic cycle. An automatically operated clamp locks the head in the cutting position before horizontal traverse of the table begins. Twenty different shaft parts are run on this one machine. Same fixture with minor adjustments handles all parts.

SUNDSTRAND MACHINE TOOL CO. ROCKFORD, ILLINOIS U.S.A.

RIGIDMILS • FLUID SCREW RIGIDMILS • AUTOMATIC LATHES • HYDRAULIC EQUIPMENT

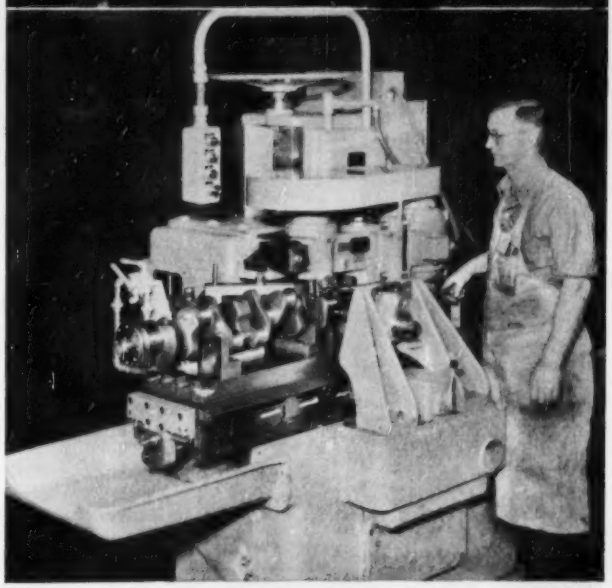
Mill Woodruff Keyways In Small Shafts . . . . . ➡

The standard No. 0 Sundstrand Rigidmil illustrated is equipped with an "accurate stop and dwell" attachment which holds the "plunge" cut on milling of Woodruff keyways to ±.0005". The part is an outboard motor crankshaft. Using the standard two-way cycle and "accurate stop and dwell" for both ends of the machine table, the No. 0 Rigidmil used on this operation increased production from 100 to 200 pieces per hour. In addition, keyways are produced more accurately, with less operator effort, and at reduced operating expense.



Have Special Keyway Milling Problems . . . . . ➡

Here's an example of a standard Sundstrand machine "tooled" for a special keyway milling job. It's a Sundstrand Model 22 Rigidmil provided with a regular horizontal spindle head for milling a straight keyway and an attached pivoting head for milling a Woodruff keyway. Both keyways are located in one end of the crankshaft and both are milled simultaneously. Keyways are held in definite relation to each other by milling both in same setting of crankshaft.



You'll Save Time and Cut Costs With Sundstrand "Engineered Production" ON ALL MILLING JOBS

If you have keyway milling problems, investigate the possibilities of cutting your production costs with Sundstrand Rigidmils. Send in part prints and complete information on your job for an "Engineered Production" analysis. To see how "Engineered Production" has been applied to many different types of milling jobs, write for this 40 page booklet. Ask for Bulletin Number 196.

SUNDSTRAND
MACHINE TOOL COMPANY
2533 Eleventh St. • Rockford, Ill., U.S.A.

DRILLING AND CENTERING MACHINES • SPECIAL MILLING AND TURNING MACHINES

Are You Finishing Your Metal Parts *the Economical Way?*

FAST, economical barrel finishing is proving more profitable in many plants than slow, hand polishing, for preparing a variety of intricate metal parts for subsequent plating operations.

You can remove objectionable heat scale, burrs, tool marks and dirt from your metal parts with this clean, modern process and with ALUNDUM Tumbling Abrasive—the ideal barrel finishing medium. You can finish large quantities of parts to exact dimensions and degrees of surface finish and prepare them for plating—ALL IN ONE OPERATION!

For full details on the barrel finishing process and ALUNDUM Tumbling Abrasive — contact your Norton abrasive engineer or distributor, or write direct to the Sales Engineering Department. If you don't have barrel finishing equipment in your plant, and if you would like to find out without obligation what this finishing process and this Norton product can do for you—Norton will be glad to make test runs for you.

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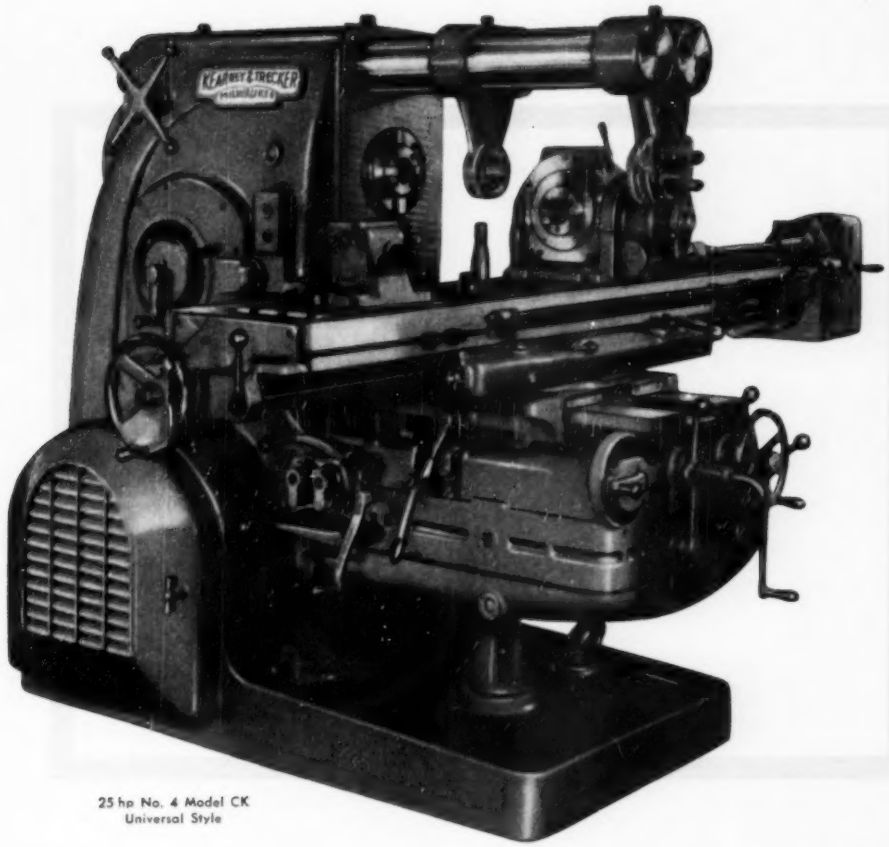
NORTON
ABRASIVES

Announcing...

KEARNEY & TRECKER'S GREAT, NEW PLAIN AND UNIVERSAL CK's



25 hp No. 4 Model CK
Universal Style

SEE the next three full-color pages for the picture-story of these new milling machines with their significant, pace-setting design features — now available to you in Nos. 2, 3, 4, 5 and 6 sizes — Plain and Universal styles.

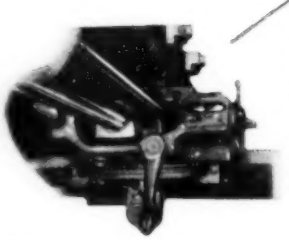
GREATER RIGIDITY — Yes, these new **CK** columns are the most rigid milling machine columns we have ever designed! They give you *1000 pounds more metal* scientifically distributed in heavier ribbing, in box section, sponson construction . . . to effectively absorb vibration from the heaviest cutting loads.

GREATER CUTTING EFFICIENCY — Added momentum of a spindle-mounted flywheel assures you longer cutter life and greater efficiency, through smoother, more positive drive — a key to most efficient use of modern cutting tools. Spindle rigidly supported by Kearney & Trecker's original 3-bearing construction.

One Look Tells Why

Here are Performance-Rated features that put Kearney & Trecker milling machines farther in front than ever before.

GREATER HORSEPOWER — when and where you need it. That's what you get with Kearney & Trecker's new **CK** independent motor drives for spindle and for feed and rapid traverse. Depending on machine size (Nos. 2, 3, 4, 5 or 6), the new **CK** machines range from 10 to 25 hp for spindle drive and 3 to 5 hp for feed and rapid traverse.

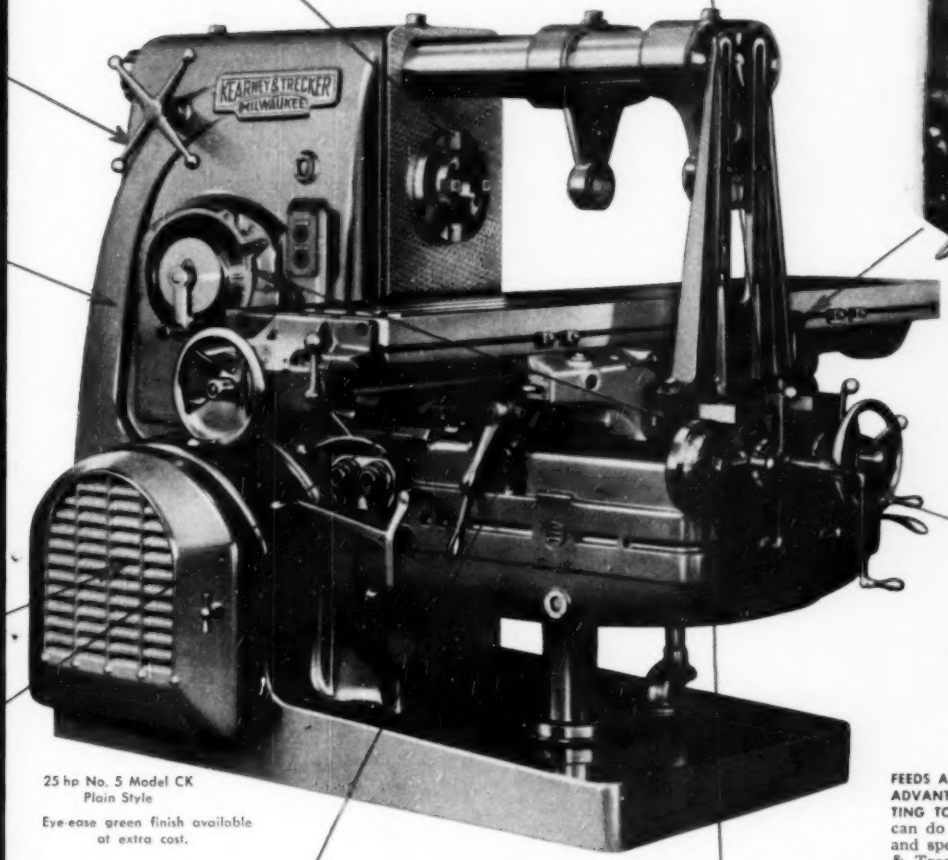


SMOOTHER FEED PERFORMANCE — with a new design 2" diam. heavy-duty, table feed screw that affords *greater bearing contact* and runs through an extra-long table feed nut. These machines have a backlash eliminator for more effective climb milling, more accuracy and longer screw life.

KEARNEY & TRECKER
MILWAUKEE
MACHINE TOOLS

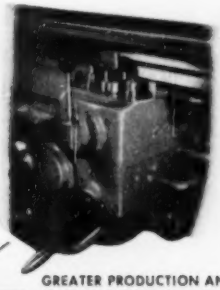
GREATER ADAPTABILITY—to more jobs. No. 60 Heavy Duty driving flange on Nos. 4, 5 and 6 machines enables you to use heavy duty arbors with Kearney & Trecker flange drive for large size single or multiple cutter setups; or to bolt large face-milling cutters directly to spindle nose. Average setups use standard arbors for No. 50 spindle drive.

NON-GLARE RAPID-SET DIALS — You'll avoid costly errors in reading and setting these new micrometer dials. They're vapor blasted to give you a non-glare satin surface with plenty of contrast for legibility of markings. They're easy and quick to set and provide a positive lock at every setting.

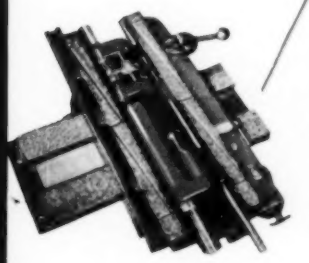


25 hp No. 5 Model CK
Plain Style

Eye-ease green finish available at extra cost.



GREATER PRODUCTION AND GREATER OPERATING CONVENIENCE — Production men will like Mono-Lever Control because it reduces idle cutter time — can raise production 16% to 96%. Operators, because it makes faster, simpler, less fatiguing work for them.



GREATER MACHINE LIFE—through adequate automatic lubrication and generously proportioned gears and shafts throughout for overload conditions. There's a forced flood system in the column and knee, and a positive metered, pressure pump system for table, saddle and knee ways, and table feed assembly.

FEEDS AND SPEEDS TO TAKE FULL ADVANTAGE OF MODERN CUTTING TOOLS — and you really can do it with the broad feed and speed ranges on Kearney & Trecker's new CK milling machines. You get 24 spindle speeds (15 to 1500 rpm on Nos. 2 and 3, 13 to 1300 rpm on Nos. 4, 5 and 6) with Kearney & Trecker's *automatic protecto-mesh shift* to eliminate gear clashing. And there's the extra-wide feed range — 32 changes from 3/8" to 90" per minute — with separate 3 or 5 hp feed and rapid traverse drive.

Select the size and model you need from this new CK line

10 hp No. 2 Model CK
Plain Style

25 hp No. 5 Model CK
Plain Style

YES, "one look tells why" — really convinces you that the Kearney & Trecker CK Line of Knee Type Milling machines offer every desirable feature to meet the demands of present-day milling operations. Yet, no single feature has been incorporated on these machines that has not been thoroughly tested and *field-proven*. Every one of them has been incorporated to make these CK machines more *accurate*, more *rugged* and MORE PRODUCTIVE. They are, without *reservation*, the finest, knee-type milling machines Kearney & Trecker has ever offered to the metal-working industry. Use the coupon below to obtain complete details and specifications of these fine new machines. See for yourself their many new and exclusive features. See how they can, by their increased accuracy, rigidity and increased productivity easily replace old, obsolete machines at substantial savings to you.

Tear Out and Mail Today

For the complete story of the new Kearney & Trecker CK line of milling machines — general specifications and plan dimensions — fill out and mail this coupon now!

Kearney & Trecker Corp.
6780 W. National Ave., Milwaukee 14, Wis.

Please send complete information on new Kearney & Trecker CK line of Plain and Universal Knee-Type Milling Machines. Indicate size of machine in which you are interested.

Machine Sizes: ☐ No. 2 ☐ No. 3 ☐ No. 4 ☐ No. 5 ☐ No. 6

Name ..... Position .....

Company Name .....

Address .....

City ..... Zone ..... State .....

KEARNEY & TRECKER CORP.
6784 W. National Ave.
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REWARD!

. . . Rich Rewards for those who find ways to use Veeder-Root Counters

Many's the manufacturer who started by saying: "But *my* product can't count — why should it?" . . . and then got interested in the idea, and proceeded to figure a way to build-in Veeder-Root Counters as standard original equipment. For which, in every case, he collected handsome rewards in added sales for the *new usefulness* offered by his product.

Counting is good business for any product . . . X-ray tubes . . . machine tools . . . engines . . . rat traps . . . textile machinery . . . guns . . . electronic equipment . . . and now, what's *yours*? Among the thousands of Veeder-Root "success stories," there is probably some experience which may point the way to uncounted opportunities for you, too. And the quickest way to find out is to get one of your design engineers together with one of ours, and let them probe for new profits. *Say when.*

FREE 8-page "COUNT BOOK" shows standard and some special types of V-R Counters for mechanical, electrical and manual operation. Write for your copy today.

VEEDER-ROOT INCORPORATED, HARTFORD 2, CONNECTICUT
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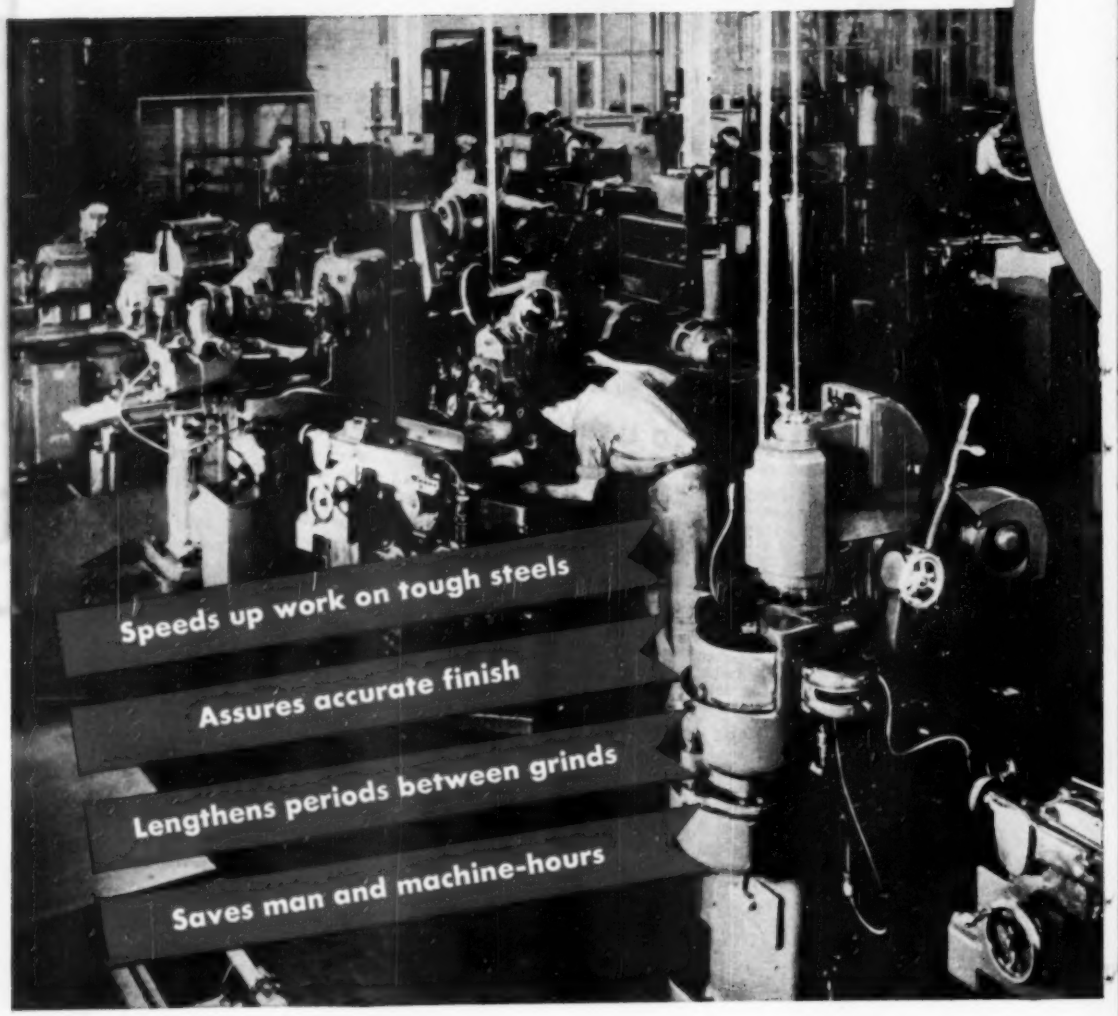
Veeder-Root COUNTERS

FOR THOSE DIFFICULT ...USE



JOBS AUTOKUT!

Wherever cutting oils are used, even for such severe jobs as broaching, threading or tapping tough alloys—whether you want speed, perfection of finish, or stock removal—Sinclair AUTOKUT Oils are the answer.

Specially compounded, heavy-duty, hard-working AUTOKUT Oils prevent welding at the tool point and preserve the cutting edge, lengthening periods between grinds.

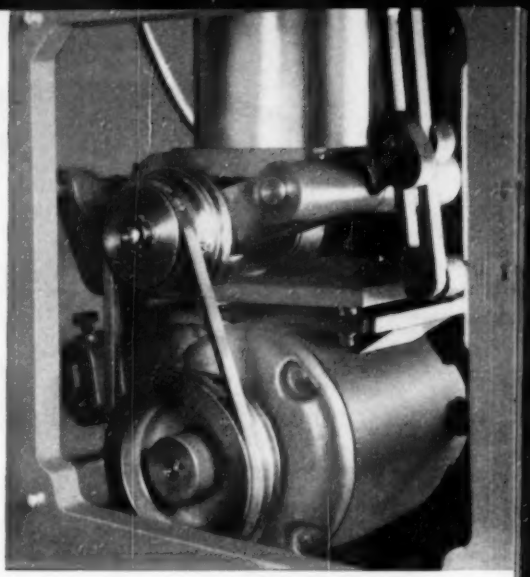
Save man-hours . . . machine hours . . . and reduce rejects—Use Sinclair AUTOKUT on the tough ones!

SINCLAIR INDUSTRIAL OILS

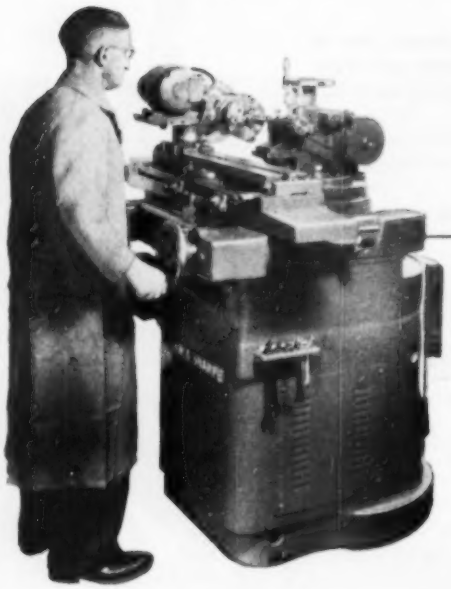
For lubrication counsel, see your nearest Supplier of Sinclair products or write Sinclair Refining Company, 630 Fifth Avenue, New York 20, N. Y.

A New Machine

with UNIVERSAL or Plain Equipment



Three rates of spindle speed provided by stepped sheaves and V belt shown here. ¾ H.P. motor and mechanism are mounted on lower end of spindle column in base of machine.

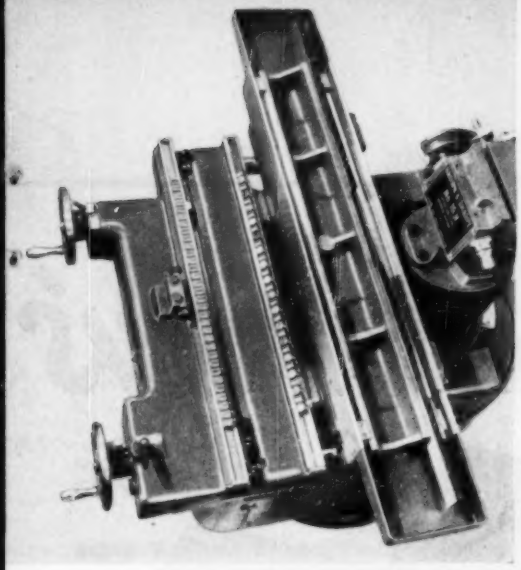


Smooth, non-cramping carriage movement is assured by precision-ground rollers on flat way together with cross feed screw located directly above V-way.

The New No. 10N

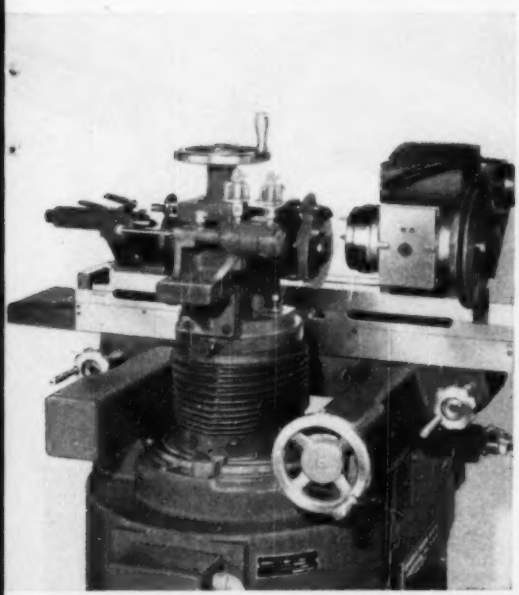
Cutter and Tool Grinding Machine

BROWN &



Easy, accurate table movement is made possible by this unique arrangement of precision-ground rolls.

Conveniently placed controls make operation of machine equally easy from front-of-table, right-rear-of-table (as illustrated) or left-rear-of-table.



Back up better PRODUCTION equipment with this modern TOOLROOM equipment

If faster production through the use of modern production machines is putting a heavier burden on your toolroom, here's a new way to offset it. The super-versatile No. 10 N Cutter & Tool Grinding Machine with Universal Equipment is especially designed for rapid, accurate cutter sharpening and miscellaneous toolroom work.

UNIVERSAL EQUIPMENT gives broad use

Where toolroom grinding involves a wide variety of jobs — light external and internal cylindrical grinding, surface grinding, etc., as well as routine sharpening — the No. 10 N with Universal Equipment offers unmatched advantages . . . a money-saver on either toolroom or production work. It includes — revolving spindle headstock equipment, internal grinding fixture, formed cutter sharpening attachment (in-feed type) and a surface grinding vise. Where toolroom grinding involves only tool and cutter sharpening, the No. 10 N with Plain Equipment may completely meet the demands of your modern production machines. The same, simple, basic design is common to both.

Designed to Save Waste Motion

Notice the following Brown & Sharpe features that mean so much to operating efficiency . . . handwheels conveniently located for fast, easy operation . . . elevating handwheel of wheel spindle is at convenient eye level . . . internal grinding fixture may be left permanently mounted (does not interfere with cylindrical or cutter grinding). These and other important features, including useful attachments, are fully described in a NEW BULLETIN. Send for your copy. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

SHARPE B·S

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

Tomorrow's

Westinghouse

Life-Line starter

TOMORROW'S STARTER—**TODAY!**

Uniform Design
in NEMA Sizes
0 through 4
.. to 100 hp, 600 volts

Starter, TODAY!

New Westinghouse *Life-Line*starter*

FOR BETTER MOTOR PROTECTION . . . LOWER OPERATING COSTS

This all-new line of a-c motor starters is announced *only after* 6 years' actual trial service, backed by 40 years of user experience in building motor controls.

HERE'S WHY it IS tomorrow's starter, TODAY:

- **Eliminates Solenoid Friction and Misalignment**—Inverted clapper-type magnet balanced on knife-edge.
- **Prevents Accidental Opening or Closing of Contacts**—Seesaw balance of clapper prevents accidental opening—kickout spring prevents accidental closing.
- **Provides Uniform Line**—Appearance and construction, NEMA sizes 0 through 4.
- **Provides Positive Opening of Contacts**—Kickout spring provides force to open contacts.
- **Provides Straight-through Wiring**—Three line leads at top; three load leads at bottom.
- **Provides Positive and Precise Overload Protection**—Snap action bi-metal DISC instead of "solder pots" or bi-metal strips.
- **Permits Front-removal of ALL Parts**—No special tools required.
- **Corrosion-resistant Parts All Plated**—Enclosure Bonderized.
- **Meets NEMA Standard Mountings.**
- **Gives Quietest Operation**—Self-aligning magnet construction.

J-30019

*Trade Mark

See for yourself. Ask your Westinghouse representative to show you "the inside story"—a Trans-Vision presentation of the Life-Linestarter. Get the facts. Write for 20-page complete line booklet, B-4677. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

If you manufacture articles or shapes like these...

There's a way to cut your costs with these Bliss machines

If your metal parts are slit, folded, flanged, beaded, seamed or threaded... you may be surprised at how you can lower costs by fitting the right BLISS machine to the job. All equipment shown on the facing page is specially designed for simple applications at a saving in cost—semi-automatic machines for limited production and fully automatic for high volume output of can ends, multiple station work and thread rolling.

Where expensive general purpose machinery is used to produce parts for metal containers, boxes, pails, toys and similarly shaped articles it may pay you to investigate the production economies of BLISS' special purpose equipment.

Just tell us to do so and we will bring experienced and specialized engineering assistance to your problems. Drawings of parts and articles to be produced with necessary hourly production requirements will be analyzed at your request and recommendations submitted without obligation.

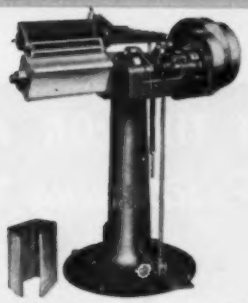
E. W. BLISS COMPANY, TOLEDO 7, OHIO

Mechanical and Hydraulic Presses, Rolling Mills, Container Machinery

BLISS CONTAINER MAKING MACHINES

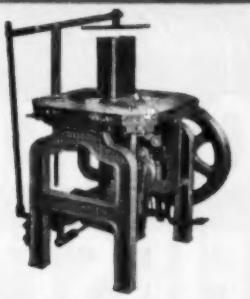
Arch press (No. 30)
Bench Power Formers
Beaders and Flangers
Combination Feed Presses
Curlers and Stackers
Double Seamers
Gang Slitters
Heavy Power Formers
Horn Presses (Nos. 16 to 42)
Inclinable Presses (Nos. 19½ to 21½)
Lock Seamers
Strip Feed Presses
Testers, Air and Water
Trimmers and Threaders

Precision slitting of Bakelite gauges sheets up to 36" wide. *No. 1235-A* Gang Slitter has manually operated back gauge and adjustable side gauges; adjustable floor steel cutters provide a range of cuts and widths.



Square, oblong, triangular or irregular container bodies—limited production. *No. 276* **Body Former has rotating horn shaped to conform to inside of can. Spring-loaded forming roll bends metal around it.**

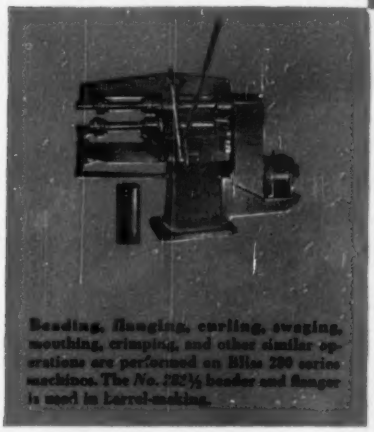
Side-seaming cylindrical bodies at one blow (1000 per hour). *No. 14* Seamer handles maximum stock thickness (.0135) for inside seams. Outside seams can be made. Maximum can height 10-7/16".



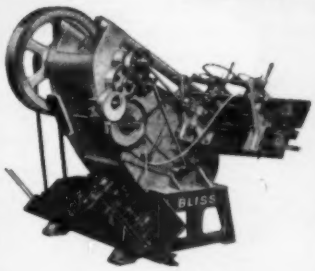
Flanging or beading square or irregular shaped cans measuring across flats up to 10". This *No. 12* **machine produces uniform flanges at both upper and lower ends of can bodies, one at a time.**

Round can double seaming with or without body automatic feeding equipment. *112* **Seamers are available in three sizes. Will seam cans in diameter 1½" to 20"; in height ¾" to 26".**

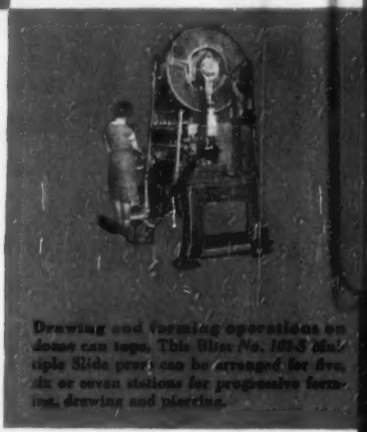
Round containers—drums, kegs, pails—are double seamed on Bliss No. 200 series (three sizes). Seaming cycle for the No. 218 (above) is 12 to 30 per minute. Handles 18-gauge can ends.



Beading, flanging, curling, swaging, mouthing, crimping, and other similar operations are performed on Bliss 200 series machines. The *No. 232½* **beader and flanger is used in barrel-making.**



Blanking and forming can ends—one, two or three every stroke (1820 series), using single, double or triple dies. Three strip-feed press sizes are available with or without special stacker feed and curlers.



Drawing and forming operations on deep can tops. This Bliss *No. 103-S* **Multiple Slide press can be arranged for five, six or seven stations for progressive forming, drawing and piercing.**

Agents for Bliss Semi-Automatic Can Machinery: Hudson Can Machinery Company, 30 Church Street, New York, N. Y.

In United States east of the western boundary of Central Standard Time Zone.

Bliss

SLITTERS · STRIP FEED PRESSES

FLANGERS · BEADERS · SEAMERS · DIES

FOR THE FIRST TIME ON ANY JIG BORER . . .

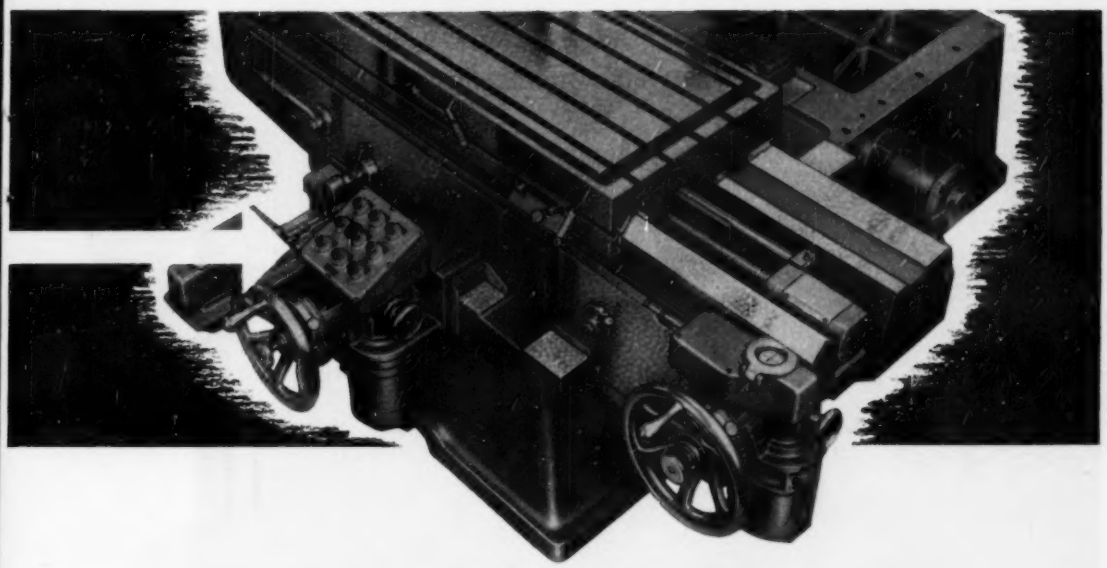
Automatic Positioning TO TABLE AND SLIDE

by PUSH BUTTON

Another:

"FOSDICK FIRST"

YOU CAN NOW POSITION THE TABLE TO PLUS OR MINUS .0001" BY MEANS OF ELECTRIC PUSH BUTTONS LOCATED AT OPERATOR'S POSITION



WHAT THIS NEW SENSATIONAL FOSDICK FEATURE MEANS TO You!

Now for the first time anywhere in the world . . . precision jig boring coupled with fast *Automatic Push-button Positioning* . . . entirely new machine flexibility for speed and accuracy in boring or duplicate drilling!

Another Fosdick *First*—another Fosdick *Exclusive*—to help you do a better job at lower cost!

With this new No. 42P Jig Borer, *automatic* table *positioning* to plus or minus .0001" accuracy is accomplished simply by pressing a button on the control panel conveniently located at operator's position. Two electrical cycles then quickly bring table to the desired position. Push buttons for rapid traverse in and out, right and left also are provided and safety switches protect the machine in all directions.

The advantages are numerous. No more need for expensive boring and drilling jigs . . . no longer is your product design frozen because of high jig costs.

New design, special parts, frequent changes . . . all are now handled with ease. Production jobs are simplified through the use of duplicating bars made quickly and accurately on the machine itself from ⅜" square stock. Often, duplicating bars are made in less time than required to machine a single part! And, a set of bars will enable you to produce as many parts as desired.

To improve or modernize your operation, investigate this Fosdick No. 42P Jig Borer with *Automatic Push-Button control.*

HERE ARE THE SPECIFICATIONS:

Table Working Area	22" x 44"
Table to Spindle	27"
Spindle Travel	9"
Head Travel	12"
Table Longitudinal Travel	42"
Table Cross Travel	18"

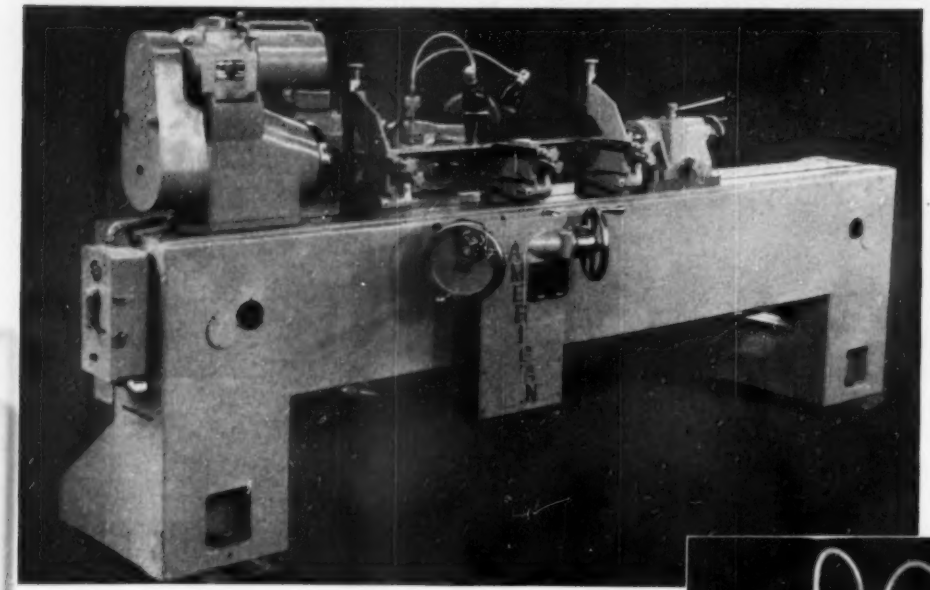
FOLDER AND COMPLETE CATALOG SENT GLADLY UPON REQUEST

CATALOG NUMBER AMJP

FOSDICK MACHINE TOOL Company

CINCINNATI 23, OHIO

• Fixed Broach • Traveling Wheel . . . the *American* way to Better Broach Resharpening



The NEW *American* ROUND BROACH SHARPENER

Can Give You These Advantages

Time Saved Through Faster Resharpening
Money Saved By Fewer Resharpenings
Part Cost Lowered By Better Resharpening

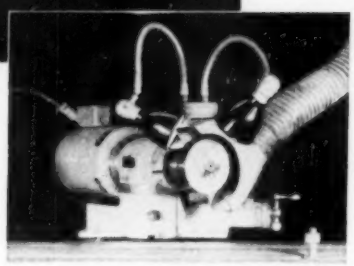
The new American Round Broach Sharpener is designed to make possible fast, highly accurate broach resharpening in your own plant. It is speedy, efficient, needs no highly skilled operator.

American designed the new RBS to overcome broach vibration which results in an inferior job. **The broach is rotated between fixed centers, while the carriage mounted grinding spindle is traversed from tooth to tooth.**

Here's what you get with this NEW idea:
1. The broach is supported above and between the pedestals. It never extends beyond the bed. This solid support minimizes vibration, improves resharpening. 2. Machine is more durable because there is less wear on vital ways with the ball-bearing mounted carriage always in full contact — never extended. 3. Resharpening is faster, and more accurate because efficient design relieves operator from mental and physical fatigue. 4. Minimum floor space required because no traveling members extend beyond the bed length.

The RBS has been thoroughly tested, for over a year in actual use, in the plant of one of the largest users of broaching in the country. It has proven highly successful. It saves time in broach sharpening, and gives a better sharpening job.

The American Round Broach Sharpener is now available in two models to sharpen cylindrical broaches up to either 60" or 84" in length and up to 9" in diameter.



Model RSB 9-84. Inset shows grinding spindle.

FEATURES of the *American* Round Broach Sharpener

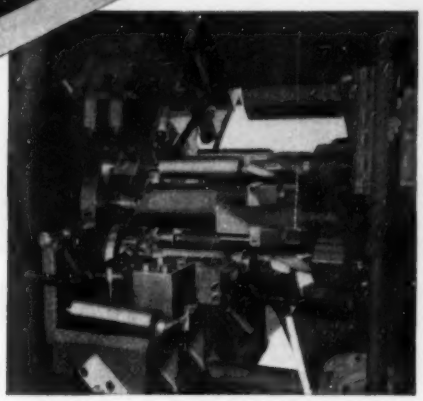
- Sturdy Construction
- Heavy Ribbed Cast Iron Bed and Pedestals
- Full Between Pedestal Support
- Simple Manual Control
- All Controls Mounted on Carriage
- Cast Aluminum Carriage Ball Bearing Mounted on Hardened and Ground Rails
- Micrometer Dial and Rapid Traverse Lockout on Left Handwheel
- Right Handwheel Controls Infeed
- Variable speed (100-500 RPM) Transmission
- Graduated Face Plate
- Quick Release Variable Tension Spring Loaded Tailstock

Write for complete informative Circular No. 800. Please address Department A.

AMERICAN *American* BROACH & MACHINE CO.
A DIVISION OF SUNDSTRAND MACHINE TOOL CO.
ANN ARBOR, MICHIGAN

See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery

What does extra-heavy drilling cost you?



Acme-Gridleys will outperform old-fashioned methods every time—*and at less cost.* Sturdy basic machine construction and positive, direct camming permits pushing large diameter drills at heavy feeds while holding close concentricity—the .002 limit on the job illustrated is typical.

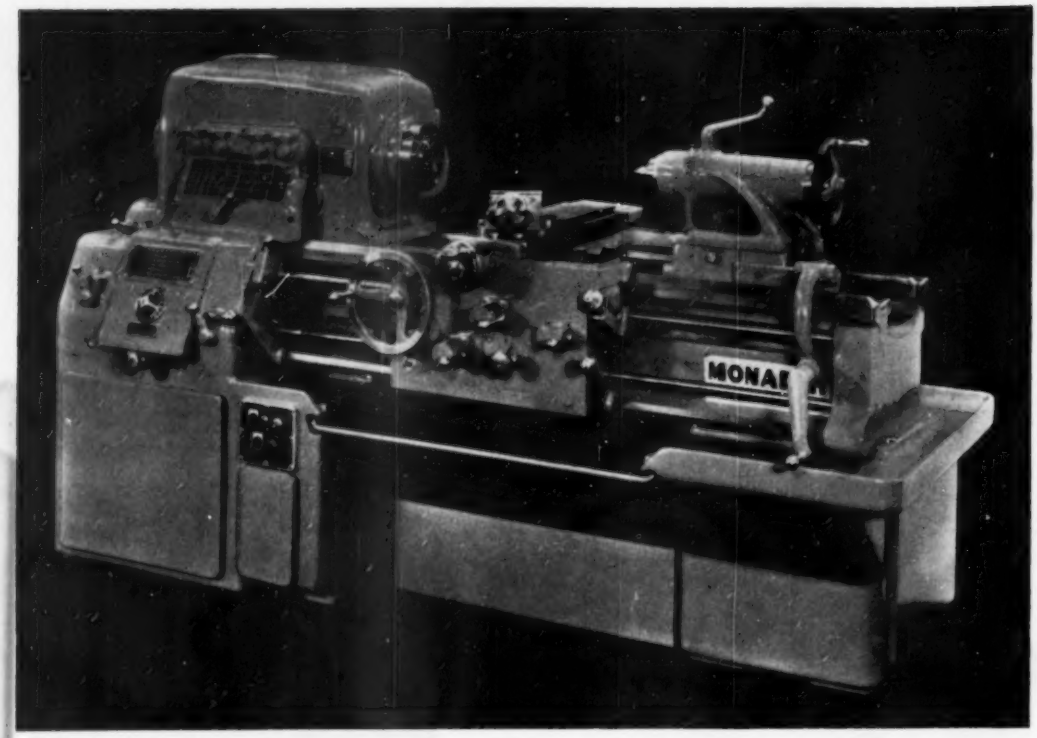
Unless your present machining methods can match this performance, you owe it to yourself to investigate what modern Acme-Gridley Automatics can do for *your* cost figures. May we give you more information? Ask for new bulletin T.P.-44, showing Top Performance on 44 jobs.

JOB FACTS

PART: Steel Shaft
SIZE: 10" x 2⅜" Diam.
MATERIAL: B 1112 Steel Bar Stock
MACHINE: Acme-Gridley 2⅝" RB-4 Spindle Automatic Bar Machine
OPERATIONS: 12
TOLERANCE: .002 Concentricity on All Machined Diameters
MACHINING TIME: 1 Minute, 30 Seconds

The NATIONAL ACME CO.
170 EAST 131st STREET • CLEVELAND 8, OHIO

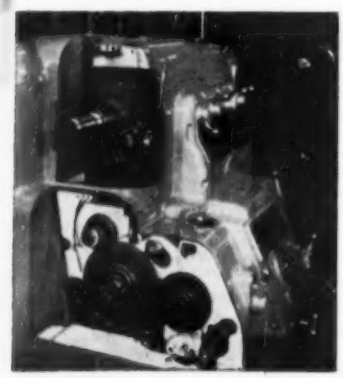
Acme-Gridley 4-6 and 8 Spindle Bar and Chucking Automatics • Single Spindle Automatics • Thread Rolling Machines • Automatic Threading Dies and Taps • The Chronolog • Limit, Motor Starter and Control Station Switches • Counters • Solenoids • Centrifuges • Contract Manufacturing



SEE THESE NEW SERIES 60 LATHES..AND SAVE!

. . . with longer life, at sustained original accuracy, preserved by totally-enclosed gearbox and end gearing. This Monarch design "plus" permits the use of automatic pressure lubrication to both. The result is years of attention-free operation, with factory-fresh precision and efficiency.

Total enclosure of these vital parts reduces normal servicing requirements to a minimum, and equally important, prevents accidental introduction of foreign matter of all kinds.



Totally-Enclosed End Gearing

Only the Monarch Series 60 engine and toolmakers' lathes have this exclusive combination of enclosed gearing—and this is just *one* of many design and construction features that mean more savings with Monarch's Series 60 Machines—available in 14", 16" and 20" sizes. You'll save on operation, you'll save on maintenance. Like more facts? Ask for Booklet 1113.

You'll Save on Maintenance and Operating Expense With These Series 60 Features:

1. Totally-enclosed gearbox and end gearing—preserves accuracy.
2. Automatic pressure lubrication—insures long life at original efficiency.
3. All anti-friction bearings—for peak power and less maintenance.
4. Hardened, ground or shaved, wide helical gears in headstock—for precision power, easier shifting.
5. American Standard Camlock spindle Nose—for quick, rigid chuck and fixture mounting.
6. Flame-Hardened and Ground Bedways—preserves accuracy—proved on over 25,000 Monarch Lathes.
7. Induction hardening of many critical parts—for long, trouble-free life.

ACCURACY · ECONOMY · LONG LIFE

Monarch TURNING MACHINES

THE MONARCH MACHINE TOOL CO. • SIDNEY, OHIO

COATED PRODUCTS COMMENTS

Another way to cut costs

Selecting an abrasive belt that turns out more pieces at a lower cost per unit has provided important savings for one concern after another. The belt is CARBORUNDUM's Industrial Cloth Belt designed to grind and polish both high and low tensile strength metals. Used on equipment ranging from backstand belt grinders to platen type belt sanders, these belts have increased production by as much as 150%—reduced unit cost by even more worthwhile amounts.

This exceptional performance is due to a sharp fast cutting action that stands up under severe grinding and polishing operations. It means more units of production per hour, for longer operating periods. We'd like to back up these claims by showing you the hundreds of cases where CARBORUNDUM's Industrial Cloth Belts provided one answer to today's high cost production conditions. Coated Products Division, The Carborundum Company, Niagara Falls, New York.

COATED ABRASIVES BY

CARBORUNDUM

TRADE MARK

Making ALL abrasive products . . .
to give you the proper ONE

"Carborundum" is a registered trademark which indicates manufacture by The Carborundum Company

M.T.

When Does a Band Saw Become a Machine Tool?

There are basic requirements of accuracy and proficiency that separate a "machine tool" from other power tools . . . characteristics such as those which distinguish a tool maker's screw-cutting, precision lathe from the woodworking lathes used in grade school manual training classes. Among metal-cutting band saws, only the MARVEL No. 8 Series Band Saws can qualify as *machine tools*, for only MARVEL Band Saws have the following capabilities and features:

1 Angular cutting from 0° to 45° right or left *without* moving the work. Built-in protractor.

2 Vertical blade power-fed into material—permits re-entrant cuts, notching, mitering, keyway sawing, etc.

3 Automatic power or manual feeds at the flick of a finger.

4 Feed pressure adjustable even when machine is running. Indicated in actual pounds of pressure.

5 Work clamped to table of machine. Working area more than 835 square inches.

6 Tee-slotted table facilitating clamping down of odd and irregular shaped pieces; easily supports heavy work or large and long structural shapes. Standard vise chucks work on either side of blade.

7 Automatic blade tensioning device. Every blade at uniform tension regardless of operating efficiency.

8 Adjustable upper guide roller holder insuring minimum section of unsupported blade on all sizes of material. Quick acting.

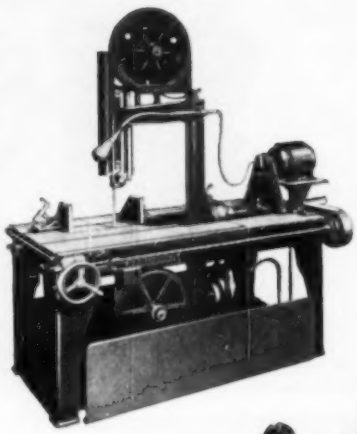
9 Built-in coolant system with delivery at blade entry point. Pump driven without belt or gears.

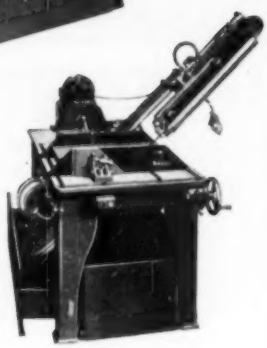
10 Replaceable vise ratchet and table wear strips of tool steel. New saw performance at all times.

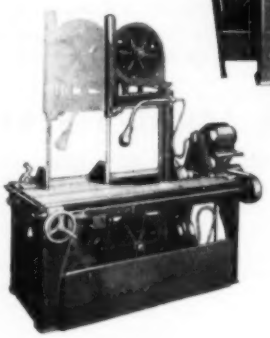
11 LARGE CAPACITY. Standard: 19½" x 18¾". High column: 25½" x 18¾". Handles 99% of all work.

Before buying any metal-cutting band saw, be sure to see the versatile MARVEL No. 8. Your local MARVEL Field Engineer will demonstrate its significant "machine tool" characteristics and their application to your work, with costs, savings, cutting speeds and methods. This technical service is provided, without obligation, in the interests of better metal sawing.

If you prefer to "study it out for yourself," write for the MARVEL C-49 Catalog.







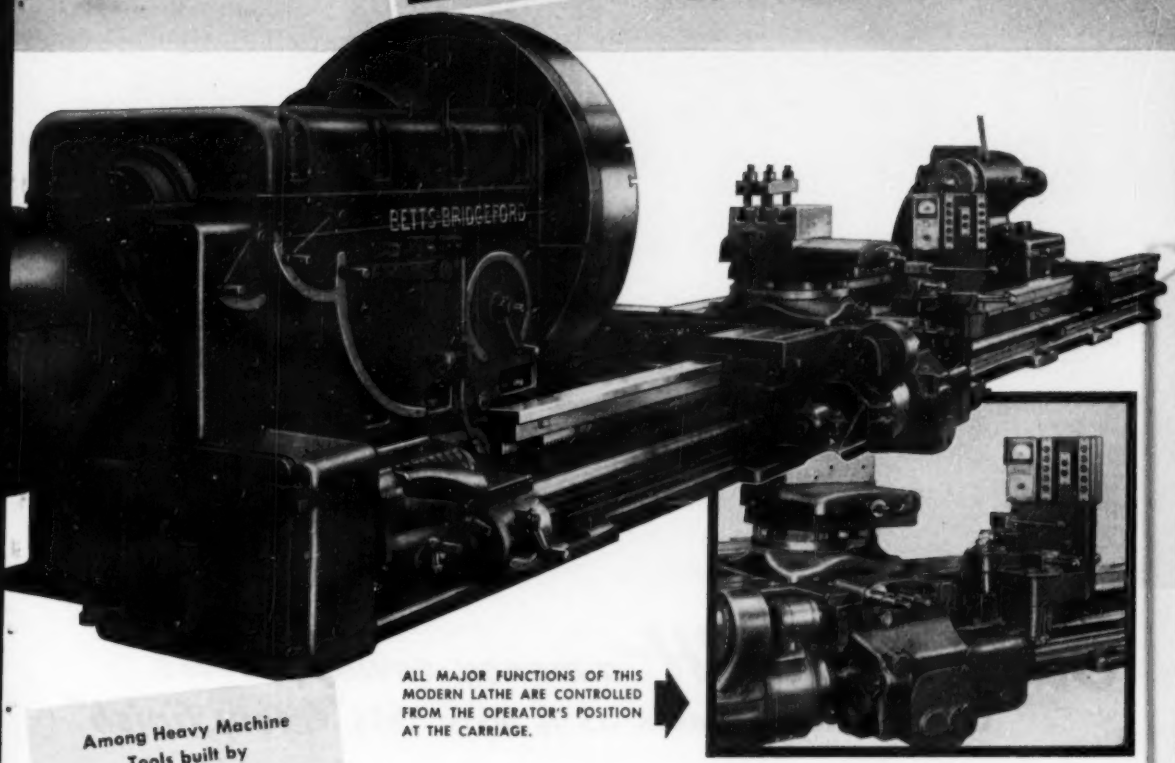
ARMSTRONG-BLUM MFG. CO.
5700 Bloomingdale Ave. Chicago, USA

MARVEL Metal Cutting SAWS
Better Machines—Better Blades

BETTS-BRIDGEFORD

ELECTRONIC FEED

60" HEAVY DUTY LATHE



ALL MAJOR FUNCTIONS OF THIS MODERN LATHE ARE CONTROLLED FROM THE OPERATOR'S POSITION AT THE CARRIAGE.

Among Heavy Machine Tools built by Consolidated are . . . .

LATHES
BORING MILLS
DRILL PRESSES
MILLING MACHINES
BORING MACHINES
COLD SAW MACHINES
BORING, DRILLING AND MILLING MACHINES
DRILL AND TOOL GRINDERS
PLANERS
SLOTTERS
RAILROAD SHOP TOOLS
AUTOMOTIVE TOOLS
AND OTHER SPECIAL MACHINES

- Wide speed range permits use of either high speed steel or carbide tools.
- Feed and traverse functions entirely independent of thread cutting mechanism.
- Feed rate and cutting speed, within the range of their respective motors, are adjustable independently without interrupting the cut.
- Lead screw for thread cutting only.
- All anti-friction bearing headstock.
- Hardened steel bedways.
- Main drive motor speeds and feed and traverse functions are conveniently controlled from the operator's position at the carriage.

- Altogether, this modern lathe embodies the advanced features necessary to meet today's demand by industry for high production with greater accuracy and durability. Full information on this lathe or other Betts-Bridgeford Heavy Duty Lathes from 26" to 144" and larger will be furnished upon request.

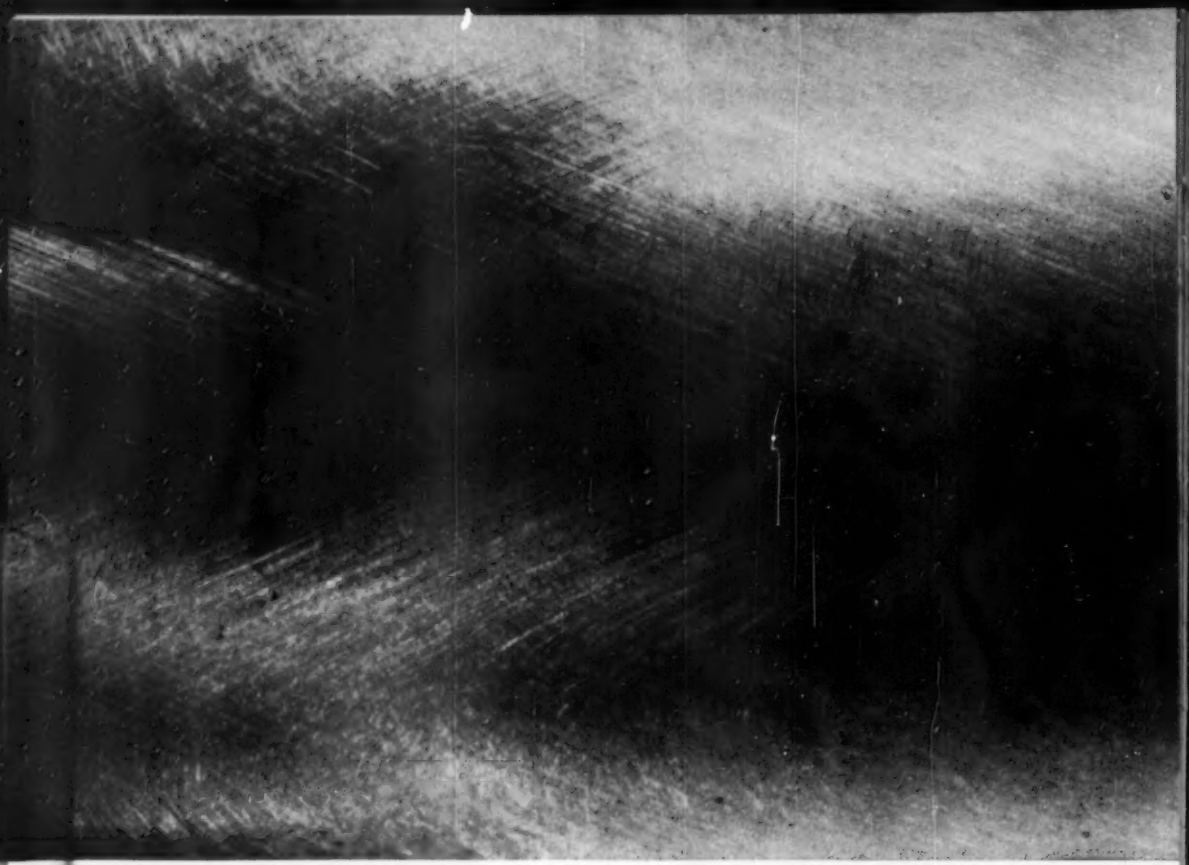
BUILDERS OF HEAVY DUTY MACHINE TOOLS SINCE 1848

BETTS • BETTS-BRIDGEFORD • COLBURN • HILLES & JONES • MODERN • NEWTON • SELLERS

CONSOLIDATED MACHINE TOOLS

CONSOLIDATED
MACHINE TOOL CORPORATION

ROCHESTER 10, NEW YORK



SUPERFINISH—*a money-saving process*

Cuts grinding costs 35% with this *"frosty finish"*

If you have thought of Superfinish as a process which adds to your cost, it's time to change your ideas. The "frosty" finish you see here is by no means beautiful, but it is just what the customer ordered—and it is giving him a better product at a 35% saving.

This is a crankshaft bearing for an Elgin Outboard Motor manufactured by the Hartford Division of the West Bend Aluminum Company exclusively for Sears, Roebuck and Company. The secret has been to alter the grinding operations. Rough grinding is now simplified and speeded up by using a free-cutting wheel. Finish grinding has been replaced by Superfinishing. Both operations are performed at the same production rate and the final finish is 10-12 Micro Inches.

In addition to the saving in manufacturing costs, there are certain quality advantages which must not be overlooked. Grinding peaks have been scrubbed away, leaving a firm bearing surface that requires no breaking in. Grinding chatter is no longer any problem, since the remaining roughness is all below the surface. The cross-hatch pattern of Superfinishing assures adequate distribution of lubricating oil throughout the bearing. It's a better surface—in addition to being less costly to produce.

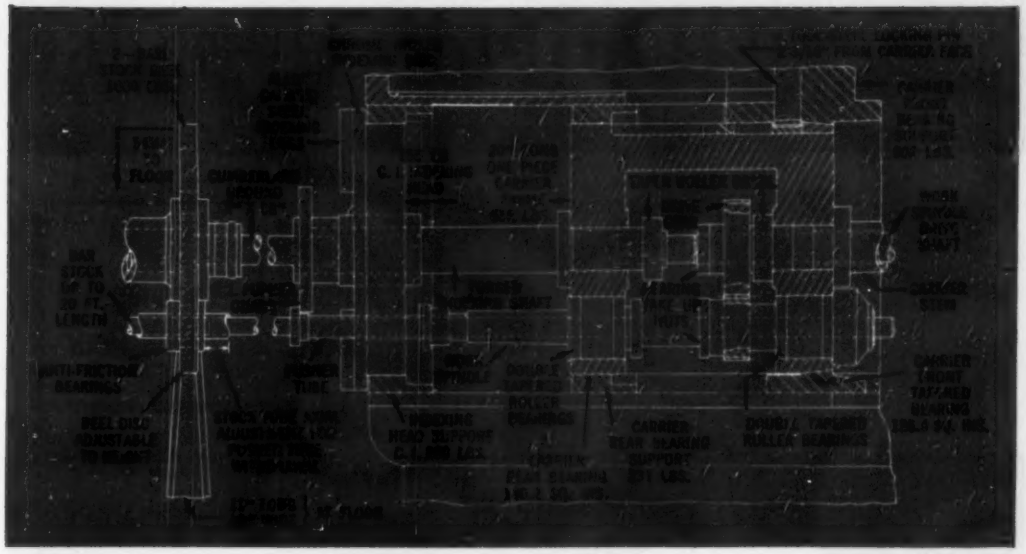
Write on your company letterhead for a copy of the textbook "Wear and Surface Finish." It's mighty good reading.

GISHOLT MACHINE COMPANY
MADISON 10, WISCONSIN

GISHOLT

THE GISHOLT ROUND TABLE *represents the collective experience of specialists in the machining, surface finishing and balancing of round and partly round parts. Your problems are welcomed here.*

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES



FIRST THINGS COME FIRST

Upon the Spindle Carrier of an "Automatic" falls the responsibility of accurately presenting and holding the work to — and in contact with — the tools. The basic design of the Carrier is obviously of first importance in the protection of the work spindles from the strain of heavy cuts and weight of the bar stock. Then, in proportion to the Carrier's ability to handle the full load is the importance of any supplementary facility that shares the load.

1. **The 1½" Six Spindle CONOMATIC CARRIER gives better support to the work spindles under heavy loads.**

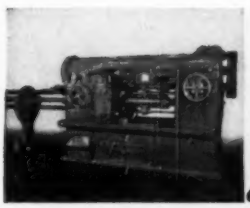
   The thick, heavy ribs resist strain. The tapered front bearing and the spindle drive gears are within 3" and 9¼", respectively, of the collet faces. The wider spaced bearings give better alignment and load distribution. The Carrier is free of Cross Slide positive stop pressure.

2. **The entire INDEXING MECHANISM is supported by the Top Bed as well as the Base. There are fewer wearing parts.**

   The Indexing Head takes the brunt of the indexing load. It is supported by the short frame member midway between the Carrier and the Stock Reel. It is joined to the latter by strong center shafts.

3. **The STOCK REEL is designed to handle longer and heavier loads.**

   The two Stock Reel Bases are independent of the machine and relieve it of the heaviest part of the bar load during the cutting and indexing movements. Adjustable alignment gives freer stock-feed action.



Buyer's Comparison Chart will guide you to full information

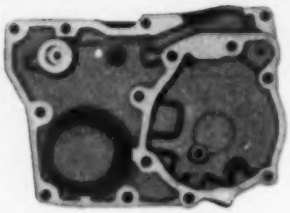
A Comparison of ALL Automatics is in Favor of Cone

Conomatic}

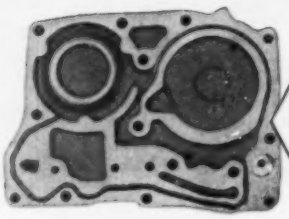
CONE AUTOMATIC MACHINE COMPANY, INC. WINDSOR, VT., U.S.A.

2700 OPERATIONS PER HOUR

Drilling, Reaming, Rough & Finish Counterboring, Chamfering, Spotfacing & Tapping

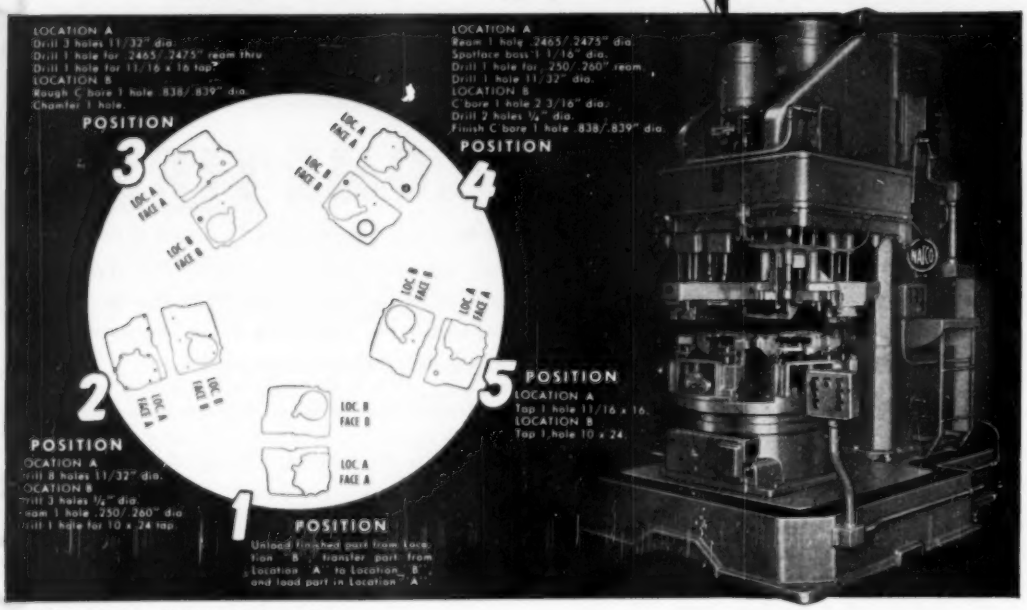


FACE A



FACE B

Producing 90 Automatic Transmission Servo Covers Per Hour


LOCATION A
Drill 3 holes 11/32" dia.
Drill 1 hole for .2465/.2475" ream thru
Drill 1 hole for 11/16 x 16 tap
LOCATION B
Rough C bore 1 hole .838/.839" dia.
Chamfer 1 hole.
POSITION 3
LOCATION A
Ream 1 hole .2465/.2475" dia.
Spotface boss 1 1/16" dia.
Drill 1 hole for .250/.260" ream.
Drill 1 hole 11/32" dia.
LOCATION B
C bore 1 hole 2 3/16" dia.
Drill 2 holes ¼" dia.
Finish C bore 1 hole .838/.839" dia.
POSITION 4
POSITION 5
LOCATION A
Tap 1 hole 11/16 x 16.
LOCATION B
Tap 1 hole 10 x 24.
POSITION 2
OCATION A
rill 8 holes 11/32" dia.
OCATION B
rill 3 holes ¼" dia.
ream 1 hole .250/.260" dia
rill 1 hole for 10 x 24 tap
POSITION 1
Unload finished part from Location "B", transfer part from Location "A" to Location "B", and load part in Location "A".
LOC. A FACE A
LOC. B FACE B
NATCO

Write today for NATCO — National Cash Register Co. "Success Story" No. 4

NATCO DRILLING, BORING, TAPPING AND FACING MACHINES

Dept. AM

THIS NEW MULTI-OPERATION NATCO HOLESTEEL MACHINE performing automatic machining operations at each of four positions simultaneously is one of many NATCO machines contributing to lower costs. Send us your drilling, boring, tapping and facing problems . . . our engineers have the solution.

NATCO

Call a Natco Field Engineer

NATIONAL AUTOMATIC TOOL COMPANY, INC., Richmond, Ind., U. S. A.

Branch Offices: 1809 Engineering Bldg., Chicago • 409 New Center Bldg., Detroit • 1807 Elmwood Ave., Buffalo • 2902 Commerce Bldg., New York City

FLEX-RITE REAMERS give greater accuracy, lower costs, higher production rates because unique blade-expansion feature *permits repeated sharpenings without reducing original size.*

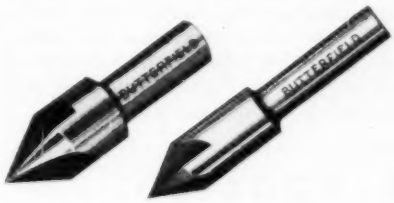
WRITE FOR SPECIFICATIONS AND PRICES.

FLUTED CHUCKING REAMERS . . . spiral and straight flutes . . . choice of straight or taper shanks . . . high speed steel.

Now . . . with FLEX-RITE the line of Butterfield 100% Inspected Reamers is Complete

TAPER PIN REAMERS . . . taper ¼ in. per ft. . . . Straight and spiral flutes in carbon or high speed steel. Helical flutes in high speed steel.

HAND REAMERS . . . straight or spiral flutes which are slightly tapered on end and cleared to edge . . carbon or high speed steel. Also expansion type in carbon steel only.



CENTER REAMERS AND COUNTERSINKS . . . 60° and 82° included angle . . . all regular in carbon or high speed steel.

STUB SCREW MACHINE REAMERS . . . high speed steel . . . regular with right hand cut and left hand spiral flutes. Reamers with left hand cut and right hand spiral flutes are special.

UNION TWIST DRILL CO.
BUTTERFIELD DIVISION
Derby Line, Vermont

BUTTERFIELD
THE 100% INSPECTED TOOLS
Every Tool Individually Inspected
TAPS • DIES • REAMERS • SCREW PLATES

ARMSTRONG

ARMSTRONG TOOL HOLDERS

are more efficient

It takes years of development, improvement and practical experience to create and perfect a line of tools. This has been the specialized work of ARMSTRONG, a contribution to machining efficiency which they have carried on continuously for 59 years.

Starting with the Armstrong Principle of inserted cutters in permanent tool shanks that "Saves: all Forging, 70% Grinding and 90% High Speed Steel," they created this unique method of tooling which has changed shop practice in over 96% of the machine shops and tool rooms. And, today, in a specially built plant, equipped with every modern facility and staffed with experts in each phase of tool making, this work goes on.

To you, as a tool user, here is always one safe principle—specify ARMSTRONG TOOL HOLDERS for every operation on lathes, planers, slotters and shapers, for turret lathes and screw machines. They are cataloged and stocked by all leading supply houses.

Write for Catalog

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"The Tool Holder People"

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Eastern Whse. & Sales Office: 199 Lafayette St., New York 12, N. Y.

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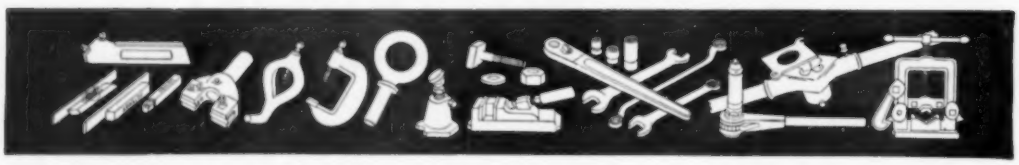
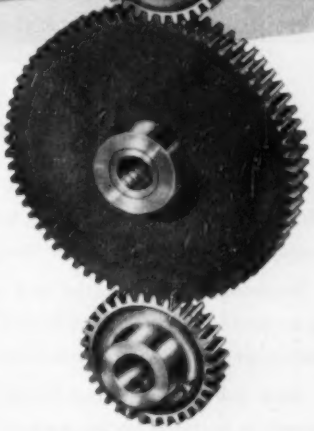


GEARS MUST BE GOOD FOR "THE PERFORMANCE Leader!"

UNION SPECIAL MACHINE CO. of Chicago stresses the *"performance leadership"* of their improved Lockstitch Sewing Machine pictured above. It offers—1. High production, 2. Fast acceleration, 3. Low maintenance, 4. Dependability, 5. Quality work, 6. Easy operation. Foremost among the parts responsible for the brilliant performance and long life of this excellent sewing equipment is G.S. Fractional Horsepower Gearing. Manufactured in production runs, with almost uncanny precision and uniformity, G.S. Small Gearing is specified by many of our country's most particular buyers from coast-to-coast. If your product calls for Gearing from 12 to 96 D.P. you are sure to benefit by submitting your needs to our skillful engineers. You see, we've been making *better* Fractional Horsepower Gearing *exclusively* for over 30 years! You can expect production runs uniformly made to the most exacting specifications from any type of materials, and *delivered on schedule.* Write today for suggestions, ideas and cost estimates. No obligation.



SEND FOR *free G.S. catalog-bulletin describing many different types and applications of our Fractional Horsepower Gears.*

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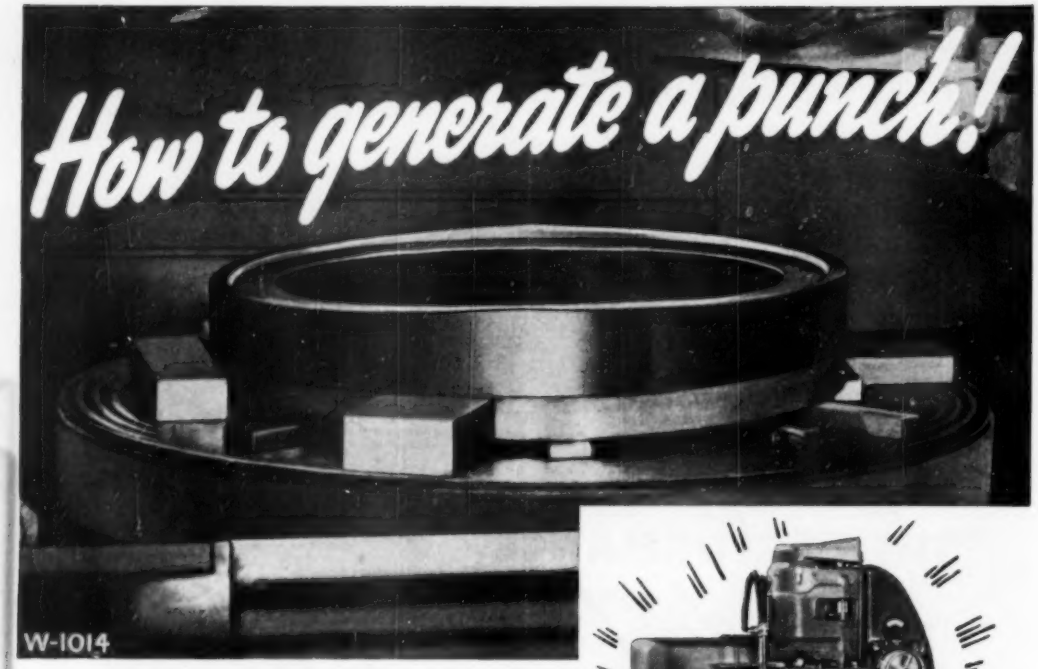
WORLD'S LARGEST EXCLUSIVE MANUFACTURERS OF FRACTIONAL HORSEPOWER GEARS

How to generate a punch!



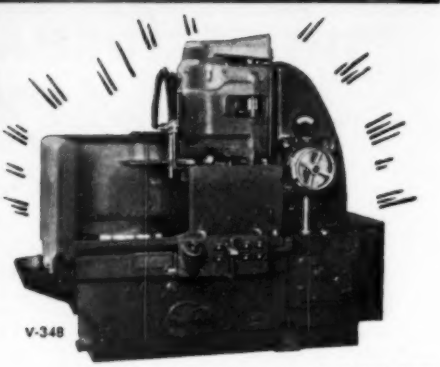
... Put it on the BLANCHARD

Obviously this is no ordinary surface grinding job—and obviously the Blanchard No. 18, with tilting wheelhead column, is the right machine for the job.

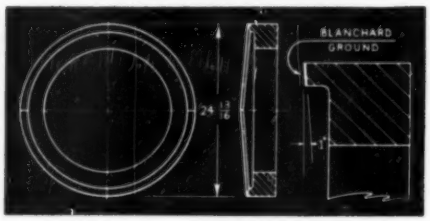
Duplicate circumferential and radial shear reliefs are generated in two set-ups on this 24 13/16" punch. Resharpening operation takes approximately 45 minutes.

Each portion is ground by the following method. The punch is centered on the magnetic chuck, and wedged to raise one side to obtain proper circumferential shear. The wheelhead is then tilted to a predetermined angle. A normal grinding operation generates the specified shape on one half of circle.

Blanchard is in a unique position to help you solve surface grinding problems that may look difficult or impossible—by methods that prove easy and profitable. Send samples or prints for free production estimates.



NO. 18 BLANCHARD SURFACE GRINDER



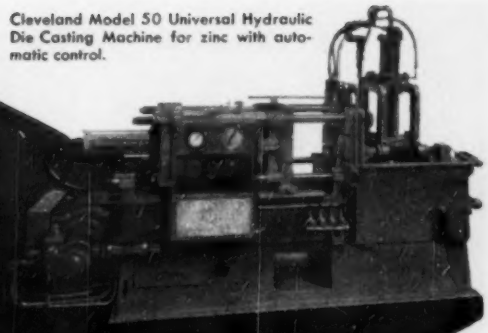
Send for free copies of "Work Done on the Blanchard," third edition, and "Art of Blanchard Surface Grinding."

PUT IT ON THE BLANCHARD **THE BLANCHARD MACHINE COMPANY**
64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.

CLEVELAND
presents with Pride

The New,

SMALL SIZE, LOW COST
Model 50 DIE CASTING MACHINE!



Cleveland Model 50 Universal Hydraulic Die Casting Machine for zinc with automatic control.

Get Fast Production on Zinc and Aluminum Parts like these with the new MODEL 50 CLEVELAND

Here is great news in die casting! Cleveland now makes available to *all* industry a rugged, small size, high production die casting machine that is priced *surprisingly low!*

Cleveland's time-proved leadership in die casting machine design has created in the new Model 50 a *fast . . . flexible . . . accessible . . . dependable* machine. It will produce dense, hardware finish castings at a very rapid rate.

Ease, convenience and safety of operation have been stressed in the Model 50 design. Construction is similar in many details to the widely used, large Model 400 Cleveland. The bed, tie bars, toggles, links, pins, platens, etc., are of heavy, rigid construction. Plenty of die handling space has been provided. A tote pan can be inserted in the bed to receive automatically ejected small parts. Either manual or automatic-timed controls can be supplied. The Model 50 converts from zinc to aluminum casting by simply changing hot metal ends.

Let a Cleveland Sales Engineer show you how this new Cleveland development can increase your production with *money saved!* A few Model 50 specifications are listed below. Write now for *complete* information.

Die Plates	22" x 18"	Die space	4" to 15"
Tie Bar diam.	2"	Die opening	8"
Locking pressure	50 tons	Floor space	52" x 116"

Weight of Zinc per shot—up to 4 lbs.

Weight of Aluminum per shot—up to 2.57 lbs.

FREE CYCLE TIME
1000+Shots Per Hour!
Actual production rate dependent upon casting size and complexity.

Remember, *Clevelands Cut Costs*

4928 Beech Street
Cincinnati 12, Ohio

SALES OFFICES: CHICAGO
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THE CLEVELAND AUTOMATIC MACHINE COMPANY

Manufacturers of a Complete Line of Single Spindle Automatic Screw Machines and High Pressure Hydraulic Die Casting Machines

The extreme hardness of Norbide abrasive is bringing increased efficiency to the lapping of cemented carbides and other hard materials. Norbide abrasive approaches the diamond in hardness and yet costs only 1/100th to 1/150th as much as diamond powder. It is successfully used in the lapping of hard materials where other manufactured abrasives do not remove stock quickly enough for economical production. Norbide abrasive is stocked by all Norton distributors. For further information and prices, write for free bulletin No. 559.

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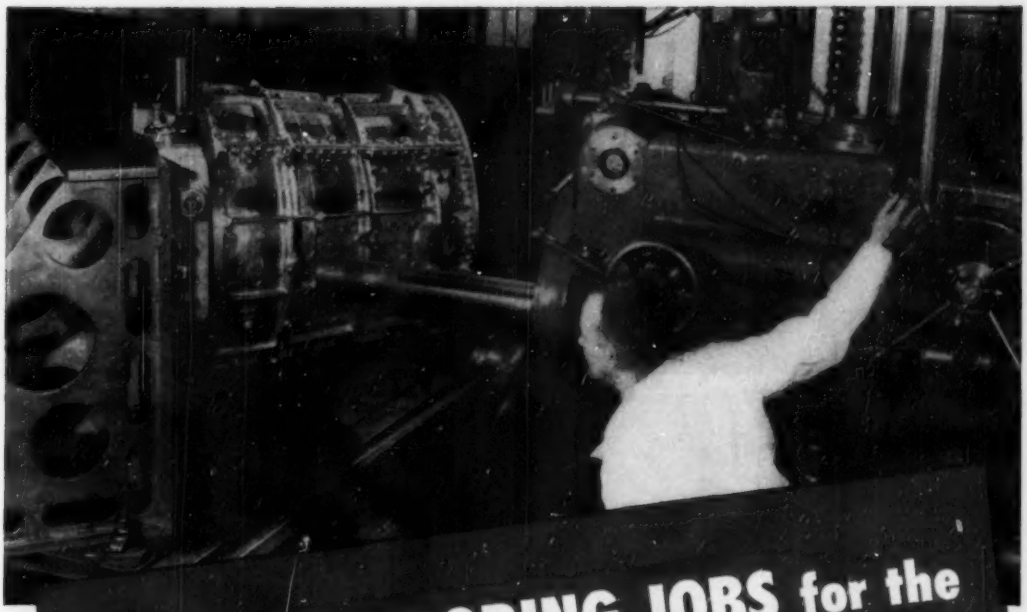
Making Better Products to Make Other Products Better



PRECISION BORING JOBS for the Famous "ORENDA" Jet Engine

The A. V. Roe Company at Malton, Ontario, find Universal Boring Machines, which are now built by The Bullard Company, ideal for varied machining operations on this exacting work.

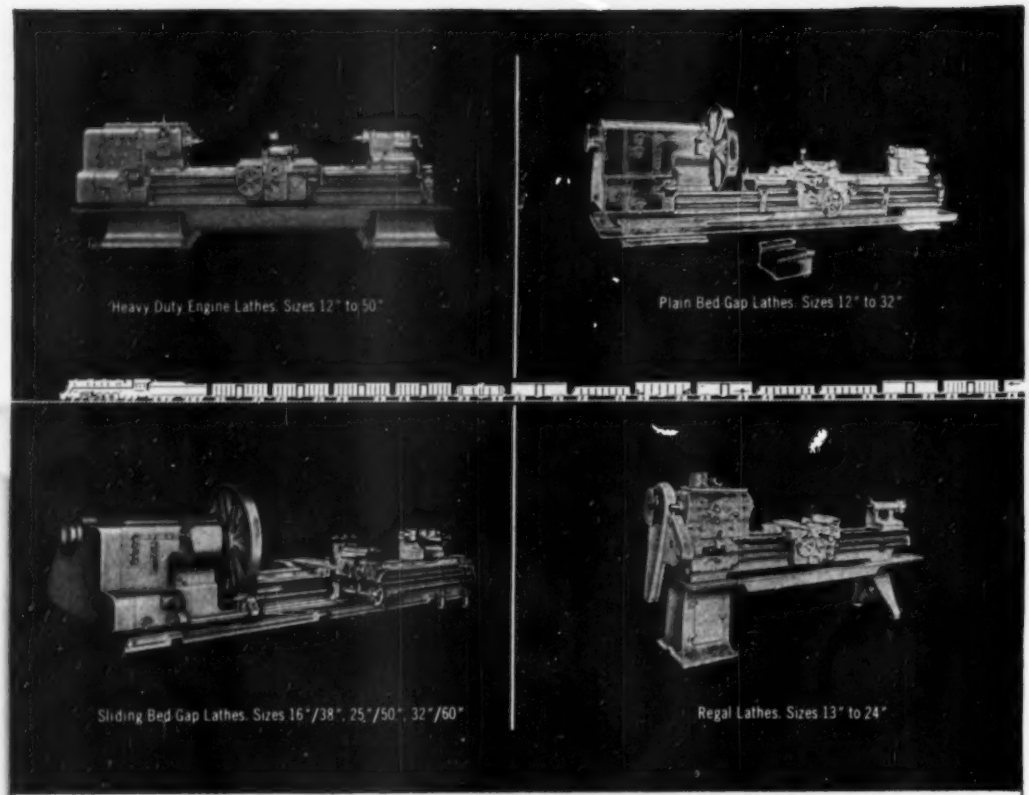
The above illustration shows the machining of a Compressor Housing, one of many operations which these machines accurately perform.

Particular advantages of the Bullard-Universal Boring Machines are their versatility and simplified right hand operation.

Close tolerances are absolutely essential in the building of this Jet Engine, and here again Bullard-Universal gives that desired accuracy.

Investigate these machines to increase production and accuracy on precision work

THE BULLARD COMPANY
BRIDGEPORT 2, CONNECTICUT, U. S. A.



Heavy Duty Engine Lathes. Sizes 12" to 50"

Plain Bed Gap Lathes. Sizes 12" to 32"

Sliding Bed Gap Lathes. Sizes 16"/38", 25"/50", 32"/60"

Regal Lathes. Sizes 13" to 24"

LeBLOND LATHES

keep rolling stock rolling!

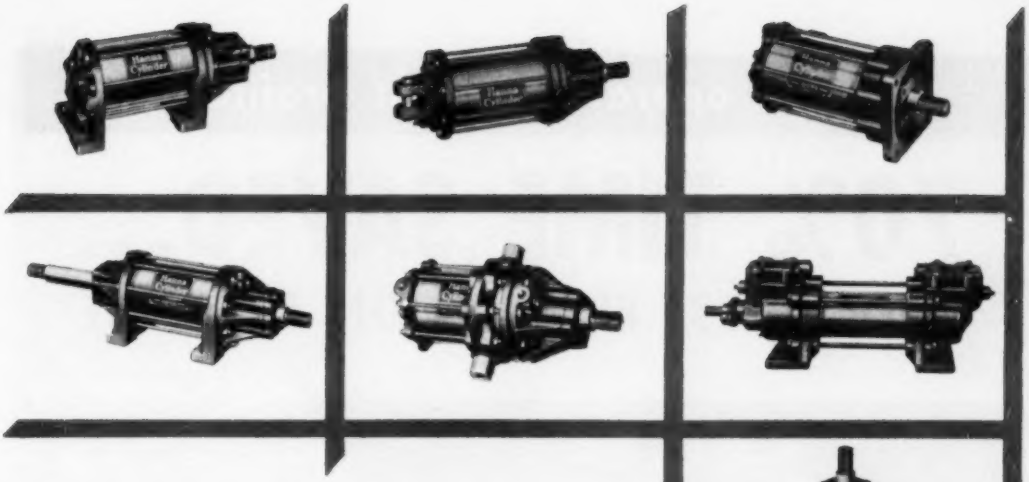
With the LeBlond heavy duty engine and plain or sliding bed gap lathes in the maintenance shop, there are few metal turning jobs you can't tackle with complete success. And adding Regals to the electrical repair shop is a smart move many roads have already made. These four modern LeBlond lathes provide speed and accuracy over a broader range of work. They're smartly engineered and constructed, and are available in a wide variety of sizes to suit your requirements.

for complete information

on this group of LeBlond lathes so widely used by the railroads, see our catalog in Sweet's File for the Mechanical Industries, or write for descriptive bulletins.

THE R. K. LeBLOND MACHINE TOOL COMPANY, CINCINNATI 8, OHIO
LARGEST MANUFACTURER OF A COMPLETE LINE OF LATHES.
SALES OFFICES: New York, Chicago, Detroit.

LeBLOND



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FOR FINEST PERFORMANCE..

Hanna LOW PRESSURE Cylinders

... for 1001 applications

Trade-Mark of Quality

Look for the familiar Hanna Label on the finest cylinders. This name-plate is a symbol of fifty years of manufacturing top-quality pneumatic and hydraulic equipment.

Hanna Low Pressure Cylinders are used throughout industry to supply smooth, dependable, low-cost power for all types of machines and equipment. Hanna Cylinders are selected to provide the push, pull, lift, press, clamp or control that is needed. They get things done quickly, efficiently and economically.

Standard Model Low Pressure Cylinders are designed for operation up to 110 psi., but with minor modifications are suitable for higher pressures with air, oil or water as the operating medium. There is a Hanna Cylinder for nearly every power application ... for nearly every mounting requirement ... for many efficient uses in your machines or equipment.

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Pneumatic Calculator... This handy "slide-rule" of pneumatic information shows at a glance the answers to many air power problems. It also helps in selecting air cylinders.

NEW CATALOG ... Hanna Catalog No. 236 includes full information on the complete line of Hanna Low Pressure Cylinders.

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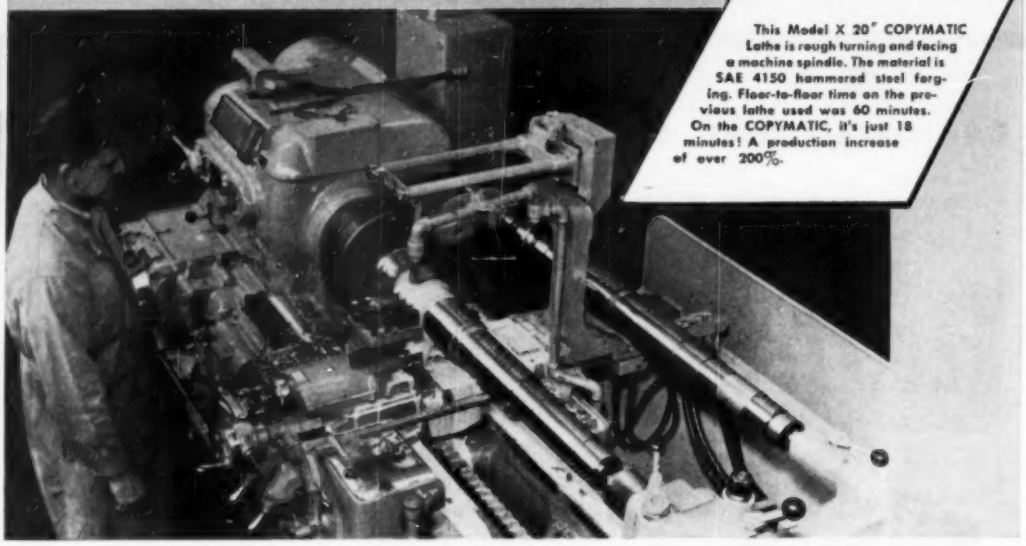
70% TIME SAVED...
OVER 200% PRODUCTION INCREASE



This Model X 20" COPYMATIC Lathe is rough turning and facing a machine spindle. The material is SAE 4150 hammered steel forging. Floor-to-floor time on the previous lathe used was 60 minutes. On the COPYMATIC, it's just 18 minutes! A production increase of over 200%.

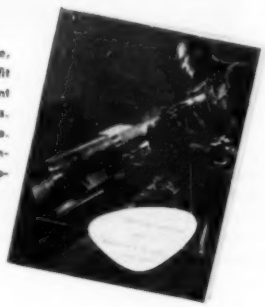
...with a Lodge & Shipley Copymatic Lathe!

Too often, failure to replace machinery means failure to produce profitably. Length of service or age is not the only factor to be considered. Lathes only a few years old may be badly outmoded when compared with new, improved machines *on a productive basis.*

The versatility and productive capacity of the COPYMATIC highly recommends it as an economical replacement. In case history reports, *by the owners,* Lodge & Shipley COPYMATICS outproduce competitive machines by significant margins. At Link-Belt Co., "Turning time cut ½." At Otis Engineering Corp., the COPYMATIC is "1st choice . . . saves 30% of time." At Continental Motors Corp., "lower tooling cost—speedy changeover." At Wyman-Gordon Co., "A time saving of 50% over other lathes."

Your Lodge & Shipley representative will gladly show you how COPYMATICS will actually save you money, speed and improve production at the same time. For details on the COPYMATIC, ask for Bulletin No. 675.

Before buying any lathe, check especially the "profit features" proved important by Lodge & Shipley users. Write for new booklet No. 200 C. L. giving detailed information on Lodge & Shipley "Profit Features."



THE Lodge & Shipley COMPANY

MACHINE TOOL DIVISION • 3055 COLERAIN
CHOREMASTER DIVISION • 800 EVANS ST.
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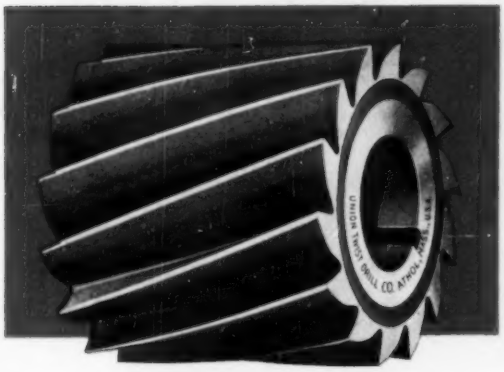
You get minimum downtime, maximum work from UNION *milling cutters*



UNDERCUT TEETH with a special spiral angle give unusual efficiency to Union plain milling cutters. These teeth afford maximum strength, ample chip clearance in the fillet and permit resharpening without rapid increase in the width of land.

TWO BIG BENEFITS you can count on when you use Union Milling Cutters: less time lost, more work done.

These performance-proved cutting tools tackle the toughest jobs in the shop . . . day in, day out . . . with a minimum downtime for reconditioning. *They cut costs as well as metal.* Union cutters work to closest tolerances . . . get outstanding results from older machines as well as the latest equipment.

If you are not already using Union tools, see your nearby Union distributor. He will be glad to work with you on any milling problem. You'll find his name in THOMAS' REGISTER on Union's insert in the "Drills, Twist" section.

A CUTTER FOR EVERY JOB

Whether you need special cutters built to your specifications or can use the standard Union cutters, there's a Union milling cutter to meet your needs. Following is a partial list —

Plain Milling Cutters	Keyseat Cutters
Helical Milling Cutters	End Mills
Metal Slitting Saws	Concave Cutters
Screw Slotting Cutters	Convex Cutters
Slitting Shears	Inserted Blade Cutters
Side Milling Cutters	Form Cutters

no other milling cutter will outperform a UNION

contact your local distributor

His name is listed in Union's THOMAS' REGISTER insert under the heading, "Drills, Twist".

UNION TWIST DRILL COMPANY, ATHOL, MASSACHUSETTS

Milling Cutters · Gear Cutters · Twist Drills · Hobs · Reamers · Carbide Tools

We own and operate S. W. CARD MANUFACTURING CO. Division, Mansfield, Mass. Taps, Dies, Screw Plates . . . BUTTERFIELD DIVISION, Derby Line, Vt., Taps, Dies, Screw Plates, Reamers . . . BUTTERFIELD DIVISION, Rock Island, Que., Milling Cutters, Twist Drills, Hobs, Reamers, Taps, Dies, Screw Plates.

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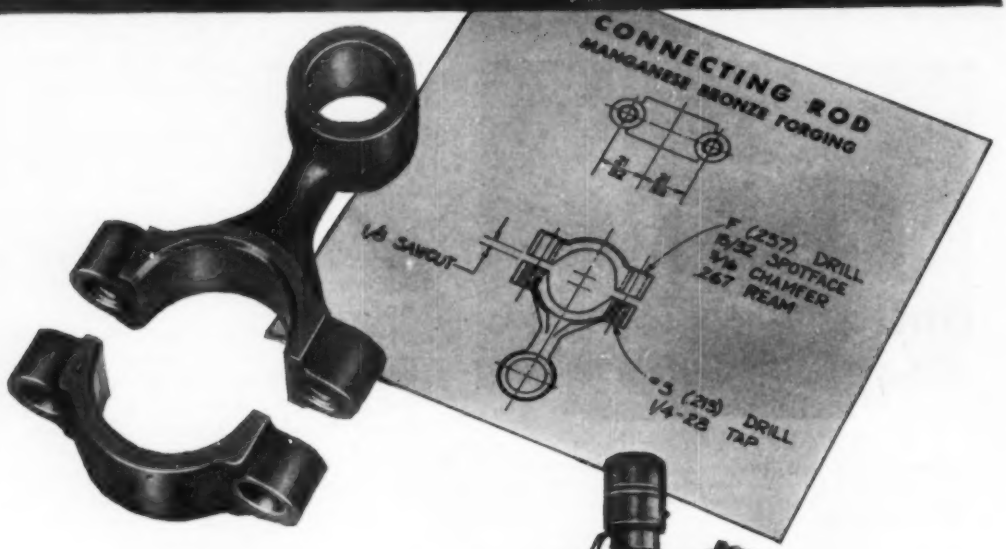
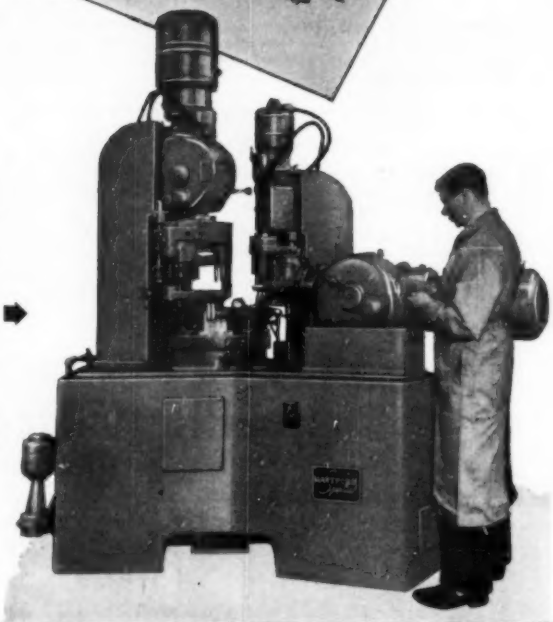


drilled, reamed tapped & parted on this Hartford Special ➡ Automatic Drilling & Tapping Machine



New Bulletin!

⬅ Send for free copy

The Hartford Special Machinery Co.
287 Homestead Ave.
Hartford 5, Connecticut

Please send me Bulletin DM-100 on your Automatic Drilling & Tapping Machines.

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Company _____

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Special
....The best buy in the long run

CARD
Spiral Pointed
TAPS
Perform Better and Last Longer

Here's Why...

For tapping deep through holes, or blind holes when there is bottom clearance for chips, Card Spiral Pointed Taps are always your best bet.

One major advantage is their superior cutting action, performed by the first few threads which are milled at an angle to the axis of the tap. This, together with the extreme rake of this feature, produces a long curling chip, which is forced ahead of the tap, as illustrated.

Chip clogging is thereby eliminated, allowing a shallow, straight fluting that increases tap strength and reduces breakage to a minimum. In fact, a single Card Spiral Pointed Tap has often completed a difficult job — cutting freely all the way and producing excellent threads — where two and sometimes three ordinary taps would be required.

For every kind of tapping job there's a Card Certified* Tap that will give you smooth, trouble-free, money-saving performance. See your Card Distributor for quick, helpful service.

Card Spiral Pointed Taps are supplied in carbon steel and high speed steel, cut thread, commercial ground and precision ground.

TAPS

The Certified Cutting Tools*

*by Pittsburgh Testing Laboratory

Also makers of a complete line of Round Adjustable Dies, Die Stocks, Tap Wrenches and Screw Plates.

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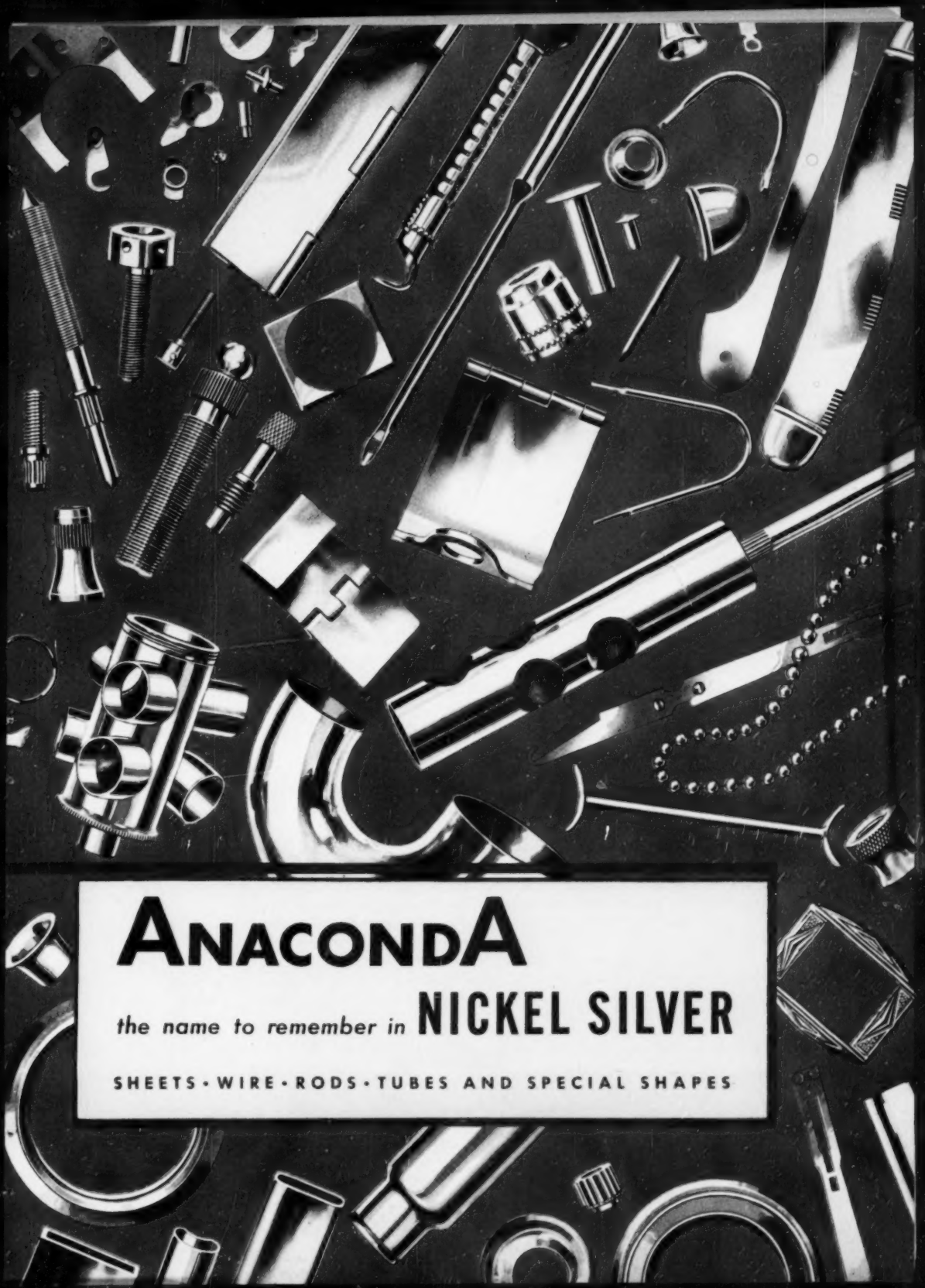
MANUFACTURING CO.
Mansfield, Massachusetts
DIVISION OF UNION TWIST DRILL COMPANY

NICKEL SILVER is beautiful in color—clear through—ranging from a soft ivory white in the low-nickel alloys, to a brilliant silvery white in alloys upwards of 18% nickel. It has higher strength and greater resistance to general corrosion than brasses containing an equal amount of copper.

It's a highly malleable and ductile metal, too . . . readily drawn, stamped, formed, spun, swaged, upset, forged, extruded, machined, soldered, brazed or welded.

Its durability, beautiful luster, ease of fabrication and moderate price, account for its broad acceptance in so many fields—both decorative and utilitarian.

Each year, millions of pounds of Anaconda Nickel Silver are produced by The American Brass Company —in all commercial forms—in all standard compositions, finishes and tempers. We'll be glad to recommend the alloy best suited to meet the individual requirements of your products. Address the General Offices, Waterbury 20, Connecticut. In Canada, New Toronto, Ontario. B2000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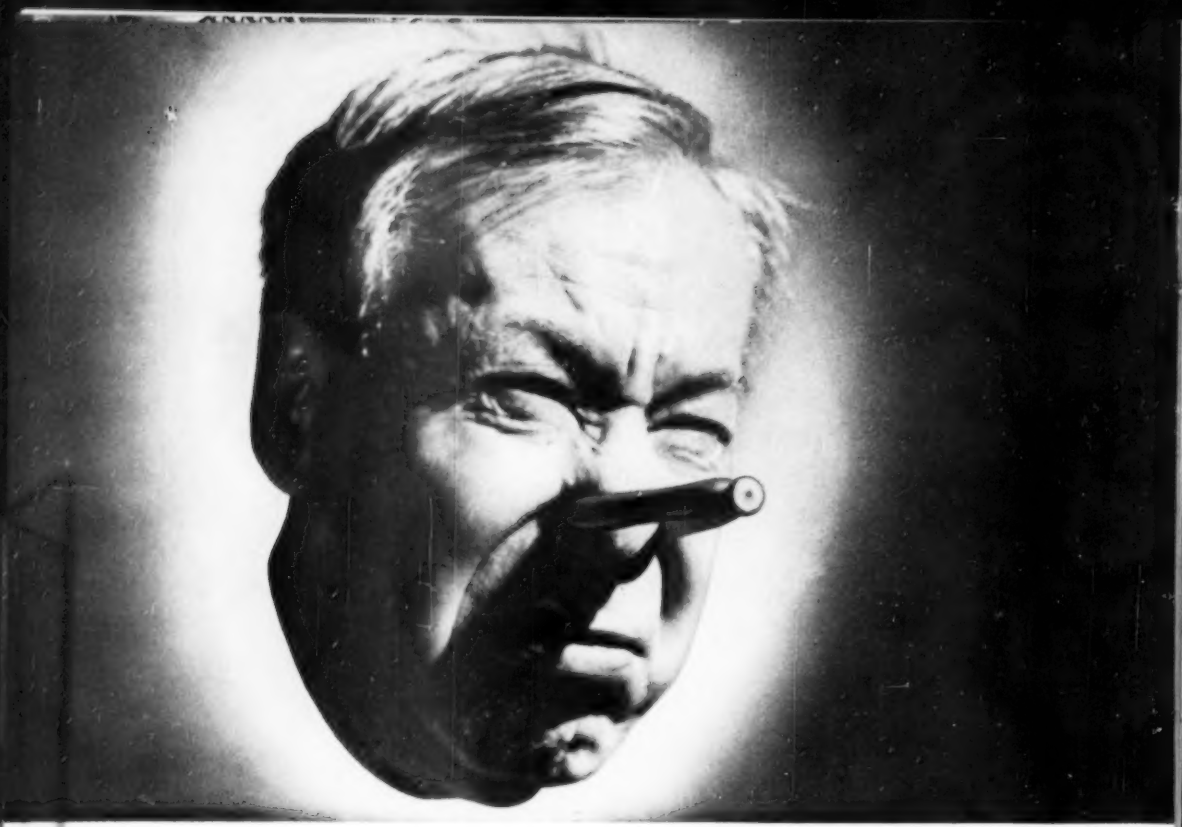


HOW TO DEODORIZE A JOB . . .

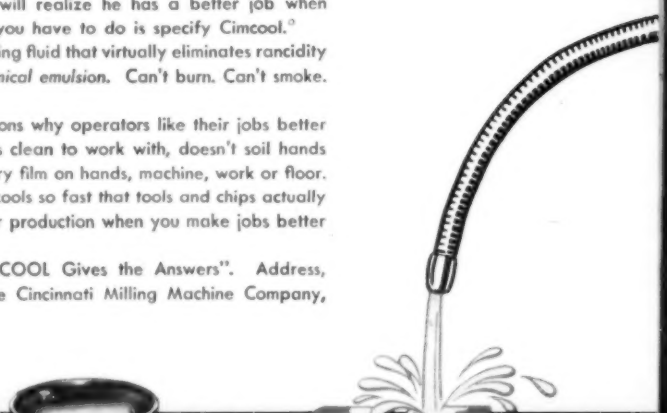
Every operator in your shop will realize he has a better job when you take the odor out of it. And all you have to do is specify Cimcool.®

Cimcool is the revolutionary cutting fluid that virtually eliminates rancidity even in the hottest weather. It's a *chemical emulsion.* Can't burn. Can't smoke. Has no objectionable odor of its own.

And those aren't the only reasons why operators like their jobs better when Cimcool is on the job. Cimcool is clean to work with, doesn't soil hands or clothes. Leaves no hazardous slippery film on hands, machine, work or floor. Contains no skin irritants. And Cimcool cools so fast that tools and chips actually stay cool to the touch. You'll get better production when you make jobs better with Cimcool!

Write for free booklet, "CIMCOOL Gives the Answers". Address, Sales Manager CIMCOOL Division, The Cincinnati Milling Machine Company, Cincinnati 9, Ohio.

®Trade Mark Reg. U. S. Pat. Off.



A Production-Proved Product of
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for 85%
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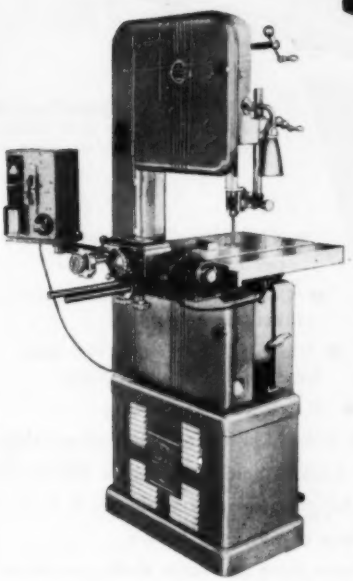
Now—for Walker-Turner 16" Band Saws

New AUTOMATIC Power Feed



Latest example of how Walker-Turner *design* helps industry speed production . . . cut costs

Overload a metal-cutting band saw and what happens? Distortion . . . blade failure . . . work stoppage . . . expense! It can't happen here — on this new 16" Band Saw.

Walker-Turner Power Feed, a revolutionary machine development, gives you positive blade protection. Motor driven, and automatically controlled by the resistance encountered at the cutting edge, this exclusive new mechanism maintains a pre-set feeding pressure. Easily adjusted for blade condition and various types of material.

Here is another example of how Walker-Turner design — *functional* design — speeds cutting time and increases machine operating efficiency. Take advantage of this engineering *plus* . . . specify the machine designed with your specific needs in mind, and cut production costs.

Ask your Walker-Turner distributor to show you the new Automatic Power Feed for the 16" Band Saw, as well as other cost-cutting equipment in the complete Walker-Turner line. Send coupon for new catalog today.

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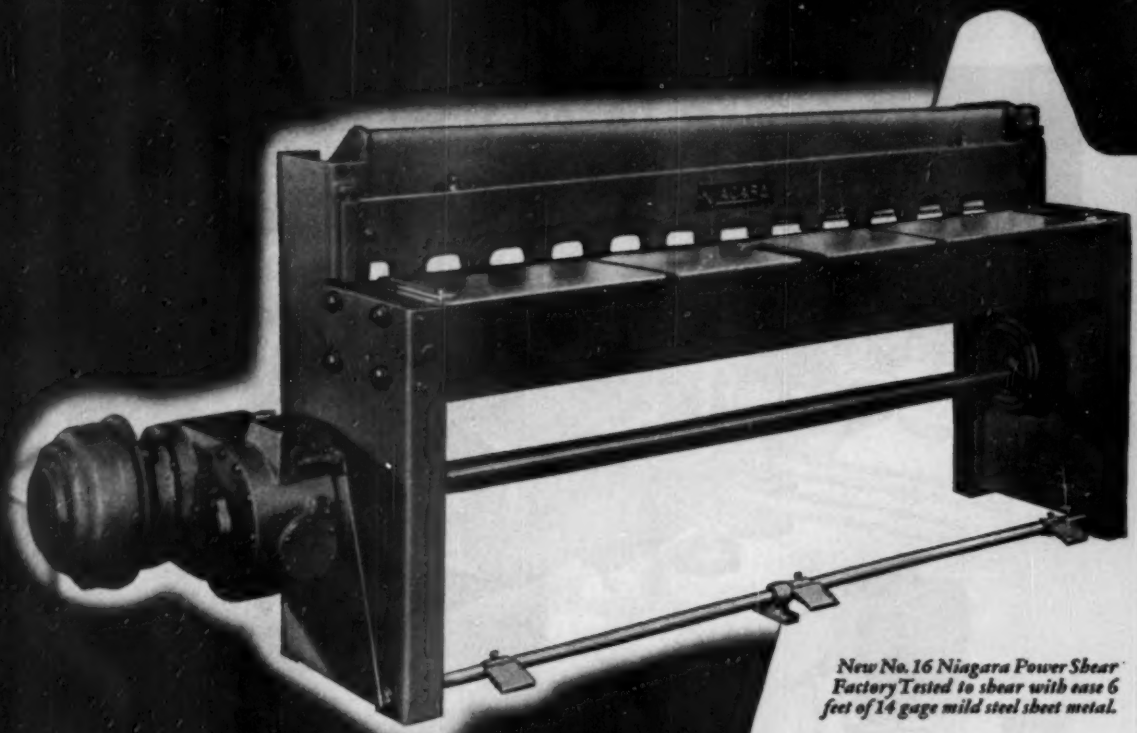

New No. 16 Niagara Power Shear Factory Tested to shear with ease 6 feet of 14 gage mild steel sheet metal.

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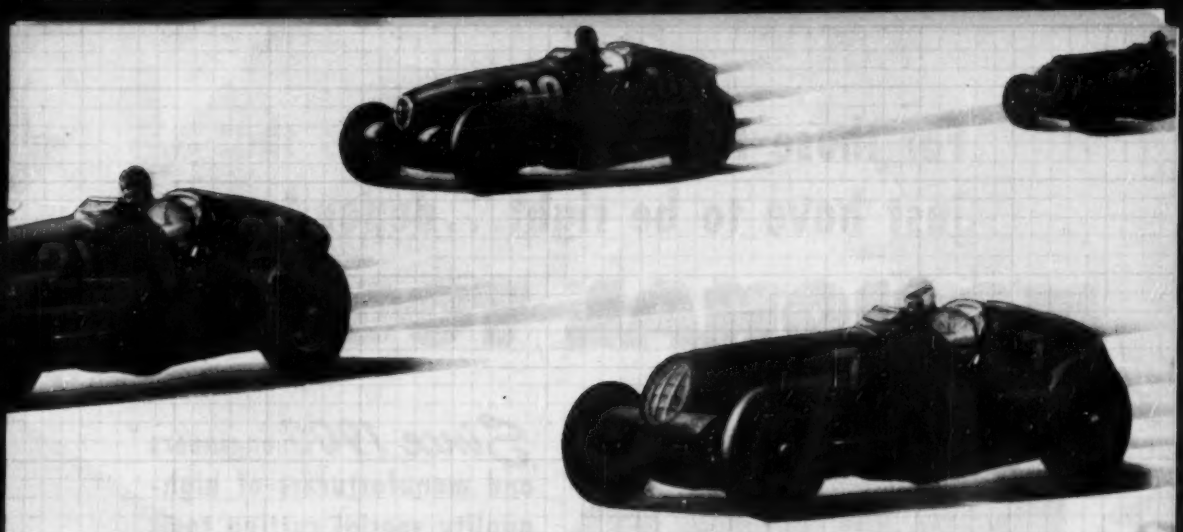

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The low coefficient of starting and running friction of compact Needle Bearings assures more efficient operation and contributes to longer service life in many high-speed installations.

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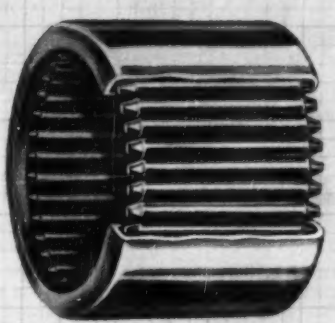

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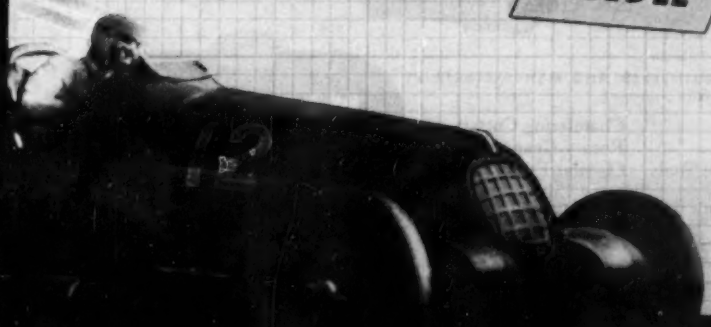

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GEAR and SPLINE HOBS custom-engineered to meet the precision and production requirements of industry

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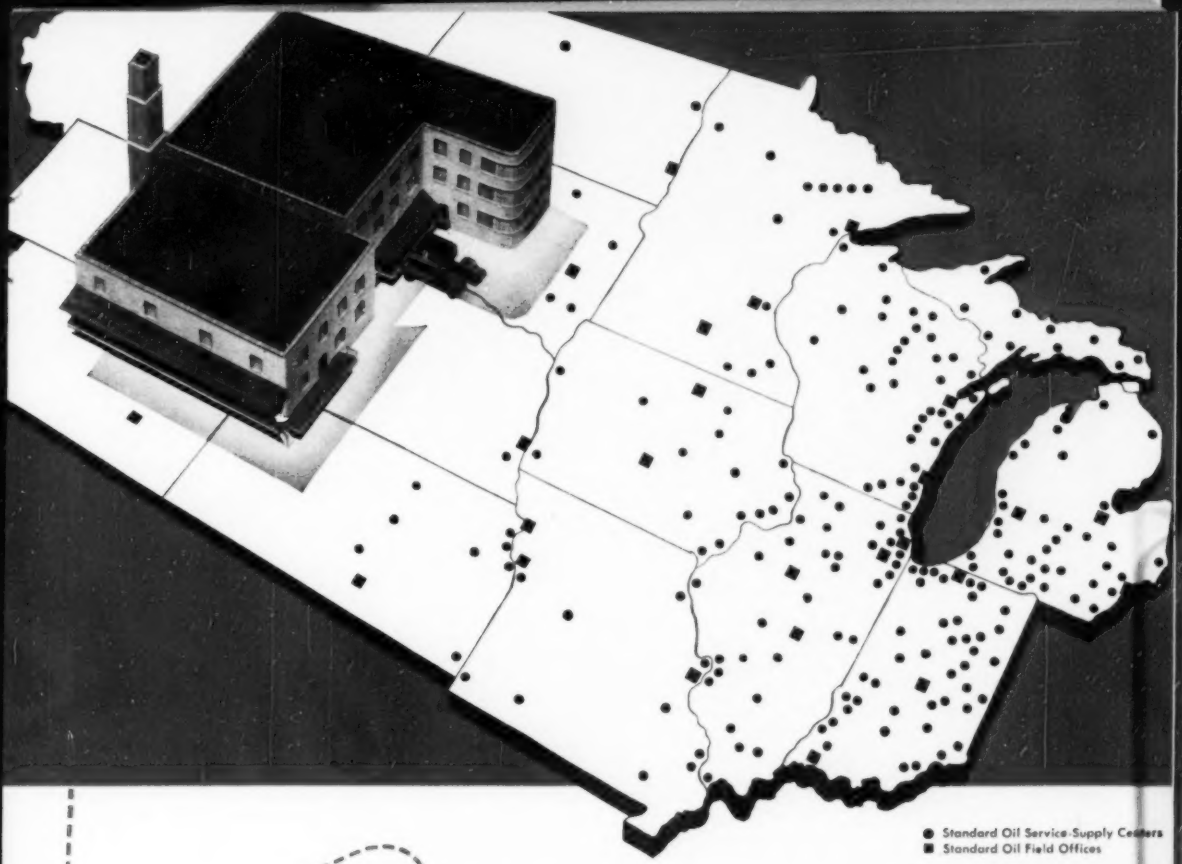

● Standard Oil Service-Supply Centers
■ Standard Oil Field Offices

Right in your own back yard!

● If your plant is in the Midwest, you can benefit from a service-distribution set-up that is unique in the oil industry – there's a Standard Oil office and warehouse practically right in your own back yard. The nearness of that service-supply center holds important advantages for you.

Faster Deliveries. You needn't worry about production delays caused by late shipments of necessary lubricants and fuels. You can avoid the expense and trouble of stocking large quantities of lubricants and fuels within your plant.

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On-the-Spot Engineering Service. Your nearby Standard Oil service-supply center is headquarters for a Standard Oil Lubrication Specialist who is assigned to your plant. He is close at hand to give you help when you need it. He has plenty of practical experience. He has been specially trained for his job in a Standard Oil Lubrication Engineering School. He is backed by Standard Oil's extensive research and technical facilities.

To arrange for his visit, phone your nearby Standard Oil service-supply center or write to: Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

3 IMPORTANT ADVANTAGES

Standard Oil's Lubrication Service is especially geared to serve your midwest operations.

1 Service-supply points are near your plant. You are assured of fast deliveries, prompt lubrication engineering service.

2 Lubrication specialists have been specifically trained in Standard Oil Lubrication Engineering Schools to help you obtain the maximum benefits from lubricants and fuels.

3 Research and technical facilities are geared to help solve your specific lubrication problems.

STANDARD OIL COMPANY (INDIANA) STANDARD

What's YOUR problem?

R. L. Jenkins, lubricating specialist at Standard Oil's South Bend office solved this customer's problem because he was thoroughly familiar with job requirements and the application of his Stanorust line.

● There is a corps of such lubricating specialists throughout the Midwest, trained and experienced to help plant operators solve similar problems. Experience enables these men to find quickly the cause of lubricating troubles. Knowledge of petroleum products enables them to prescribe the lubricant needed. There is one of these lubricating specialists at the Standard Oil Company (Indiana) office near you. He is there to serve you. A call or a card will put him at your service.

Investigate the cost-saving possibilities of these lubricants.

STANOIL INDUSTRIAL OILS—for cleaner hydraulic systems, gear cases, compressors, and circulating systems.

CALUMET VISCOUS LUBRICANTS—adhere to open gears and chain drives without throw-off. Easy to apply. No heating.

STANOLITH GREASE—withstands high temperatures and resists washing by water.

THE SHOP FOREMAN of Hart Pressed Steel Corp., Elkhart, Indiana, exposes the clean metal surface beneath a coating of STANORUST 1-XC Rust Preventive by a simple wiping operation. The die shown has been protected against rust under severe outdoor conditions for over a year by STANORUST 1-XC.

How to prevent rust under severe outdoor storage . . .

RAIN, snow, heat, cold—plus coal soot from passing locomotives—could be expected to produce serious rust troubles in outside storage. The elements did, indeed, cause difficulties for the Hart Pressed Steel Corp., Elkhart, Indiana, which owns the truck and trailer dies shown above. Despite coatings of heavy oil, rusting was so severe that cleaning a die required at least three hours.

The problem was laid before a Standard Oil lubrication specialist. He pointed out that, to withstand severe outdoor exposure, a rust preventive with special qualities is needed. At his suggestion, the dies were coated with STANORUST 1-XC, a rust preventive especially developed for severe outdoor service.

Use of a STANORUST Rust Preventive has made savings for this company. Many of the dies have been exposed to the weather for over a year, yet STANORUST has kept them completely protected against rust. A die can now be cleaned and returned to service in a matter of ten minutes, as compared with the three hours previously required.

The new and improved STANORUSTS can mean big savings for you through more economical applications, better rust protection. There's a lubrication specialist near you who can help you get the most economical results. How you can obtain his services is described at left. Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

STANORUST
REG. U. S. PAT. OFF.
RUST PREVENTIVES

STANDARD OIL COMPANY (INDIANA) STANDARD

Best Buy in Variable Speed!

COMPARE THESE FEATURES of *Vari-Pitch* Automatic sheave with any other variable speed drive and see why *Vari-Pitch* Automatic drive gives you more for your drive dollar.

1. **Changes speeds with one hand while machine is running.**
2. **All mechanism is inside one sheave actuated by movement of the motor base.**
3. **Ample capacity and safety factor of multiple belts.**
4. **Full range of sizes from 1 to 40 hp.**
5. **Top speed is 100% higher than low speed.**
6. **Quiet operation.**
7. **Cushioned start.**
8. **Simple design and easy installation make cost low**
9. **Occupies no more space than ordinary sheave.**

Vari-Pitch Automatic drive will pay for itself very quickly in increased production, improved quality and more flexible operation on many machines in your plant. Ask your Allis-Chalmers Authorized Dealer or Sales Office representative to give you savings and cost figures on your operations. Or write for bulletin 20B7223.

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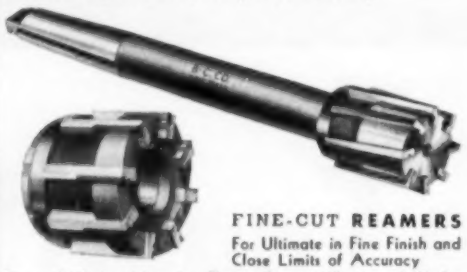
Increased Chip Clearance, Stronger Tooth Backing



FINE-CUT REAMERS

For Ultimate in Fine Finish and Close Limits of Accuracy

Pin and Wedge Mounting Permit Greater Number of Blades for Improved Finish
Blade Adjustment Gives Long Life with Minimum Maintenance Cost

SOLID FLUTED REAMERS

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Twenty-five years of practical reaming experience cost nothing when you buy Barber-Colman Reamers. Yet this background provides the ultimate in production reaming design, fewer inspection rejects and lowest reaming cost. Check your reaming operations and consult with Barber-Colman Reaming Engineers. Their reaming experience will prove results with maximum job performance. A complete stock selection is available to meet your specific requirements.

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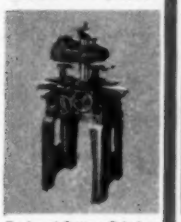

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Motor and switch extra in some cases.

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The Grinder with built-in goggles

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3 Band Saws | Sprue-Cutting Saw | 3 Cut-off Machines | 3 Welders | 11 Drill Presses

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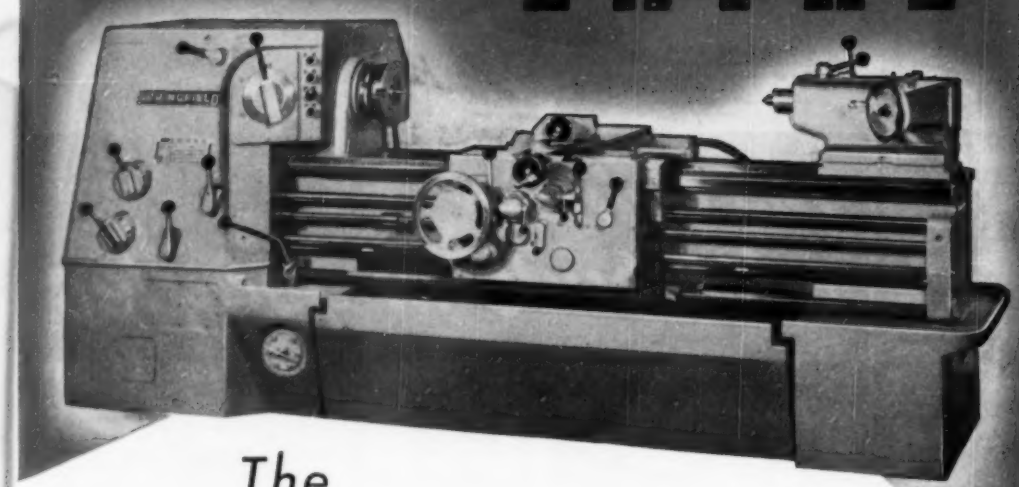

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Jig Borers – Six types ranging in table sizes from 4" x 4" to 28" x 20½"

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Various Types of High Precision Drilling Machines – Maximum spare between centers, 16"

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Automatic Drilling & Tapping Machines

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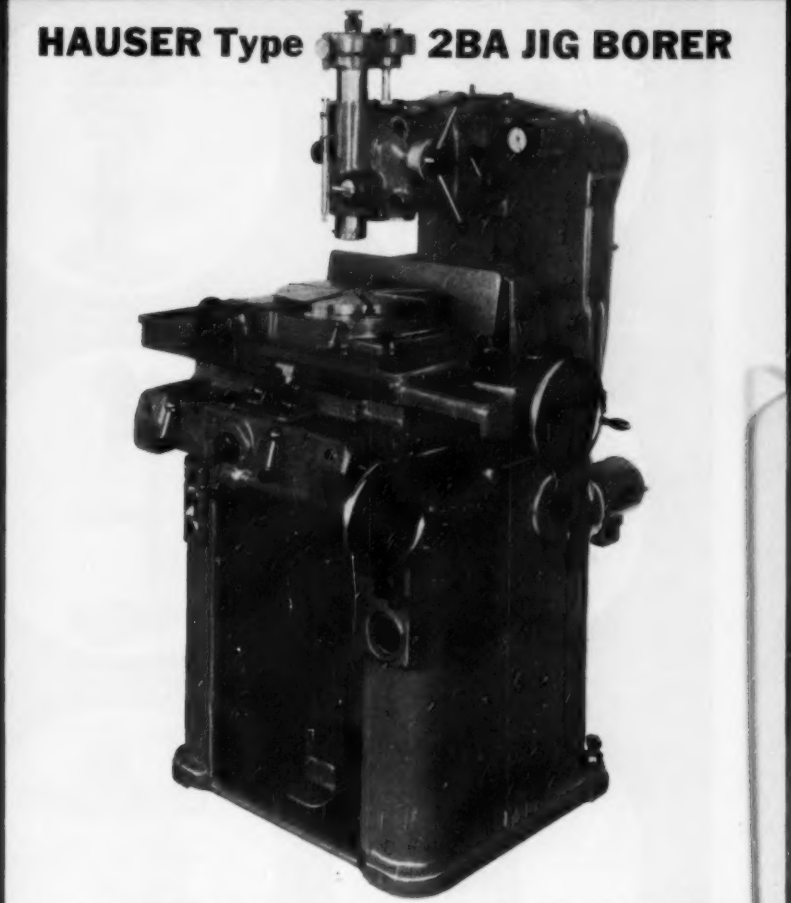

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Combining the highest degree of precision obtainable in any machine of similar capacity with ease of set-up and operation, this superb Swiss Jig Borer is typical of the six famous Swiss lines now available to American industry through Hauser Machine Tool Corp.

Bores to 2½" diameter—Drills to 23/32"
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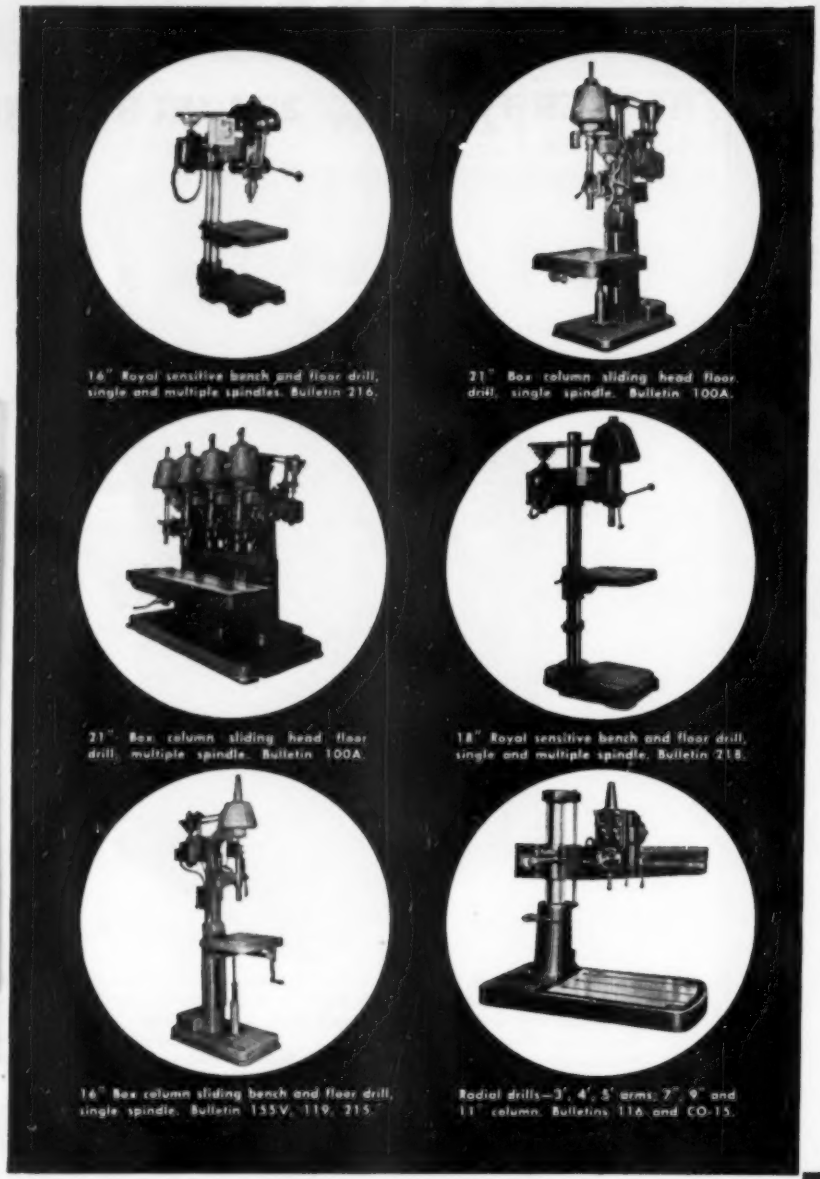

16" Royal sensitive bench and floor drill, single and multiple spindles. Bulletin 216.

21" Box column sliding head floor drill, single spindle. Bulletin 100A.

21" Box column sliding head floor drill, multiple spindle. Bulletin 100A.

18" Royal sensitive bench and floor drill, single and multiple spindle. Bulletin 218.

16" Box column sliding bench and floor drill, single spindle. Bulletin 155V, 119, 215.

Radial drills—3', 4', 5' arms; 7", 9" and 11" column. Bulletins 116 and CO-15.

how to drill an argument full of holes

The familiar "we can't afford it" argument will very likely go to pieces when matched against high money saving productivity and low initial cost in the Canedy-Otto Cincinnati line of light, upright, sensitive and radial drilling machines. They offer the sizes, types, speeds, feeds and adaptability to fit better than 90% of your drilling requirements... The Canedy-Otto line is now backed by a leading name in lathe manufacture. Write for latest literature.

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On mass-production lines and under exacting precision stamping requirements, Danly presses are establishing new performance records. Outstanding improvements in press engineering, design and construction assure longer uninterrupted production runs, increased die life and greater operating safety.

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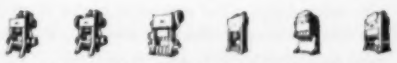
*The 175 ton straight side DANLY press shown is located in the new A. B. Dick plant, manufacturers of mimeograph office equipment.



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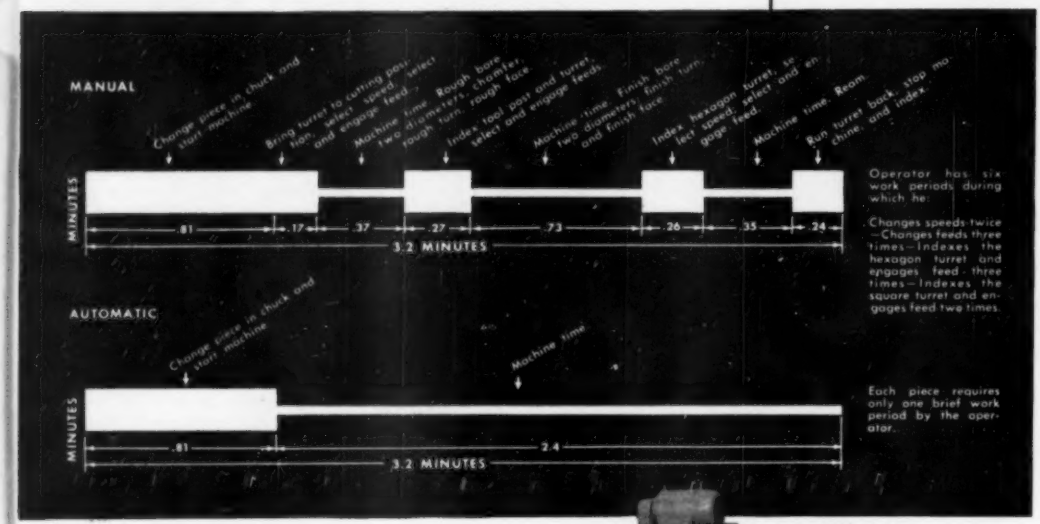
how the
GISHOLT FASTERMATIC
saves man-minutes and money!

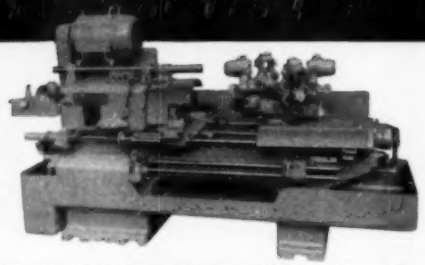
Here is an actual comparison of the time and work cycle of a manually operated turret lathe and a Gisholt Fastermatic Automatic Turret Lathe. The machining of wheel hubs, shown above, requires 6 operations as follows: rough bore, finish bore, ream, rough face, finish face and chamfer. Note that the manually operated machine takes over 54% of the operator's time whereas the Fastermatic takes only 25% of his time, leaving 75% without interruption.


MANUAL
Change piece in chuck and start machine
Bring turret to cutting position, select speed, select and engage feed
Machine time. Rough bore, two diameters, chamfer, rough turn, rough face
Index tool post and turret, select and engage feeds.
Machine time. Finish bore, two diameters, finish turn, and finish face
Index hexagon turret, select speed, select and engage feed.
Machine time. Ream
Run turret back, stop machine, and index
MINUTES
.81
.17
.37
.27
.73
.26
.35
.24
3.2 MINUTES
Operator has six work periods during which he:
Changes speeds twice—Changes feeds three times—Indexes the hexagon turret and engages feed three times—Indexes the square turret and engages feed two times.
AUTOMATIC
Change piece in chuck and start machine
Machine time
MINUTES
.81
2.4
3.2 MINUTES
Each piece requires only one brief work period by the operator.

That's the story of the Fastermatic in a nutshell—less work time for the operator. The Fastermatic handles all changes of feeds and speeds automatically.

In this case, for example, the other side of the work piece is done by another Fastermatic with substantially the same cycle. One operator keeps both machines constantly under cut and still has ample time for stacking and work inspection. Important, too, is the fact that both Fastermatics are tended by a comparatively unskilled operator.

There are many such cases where Fastermatics can cut costs substantially. Gisholt engineers will gladly answer your questions. Write us.



THE GISHOLT 1-F FASTERMATIC—*smallest of 3 different sizes which enable you to machine a maximum number of surfaces in one chucking, handling all changes in speed and feed automatically. On this job, turret was double-tooled so that two parts were completed with each revolution of the turret. Ask for literature.*

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

GISHOLT

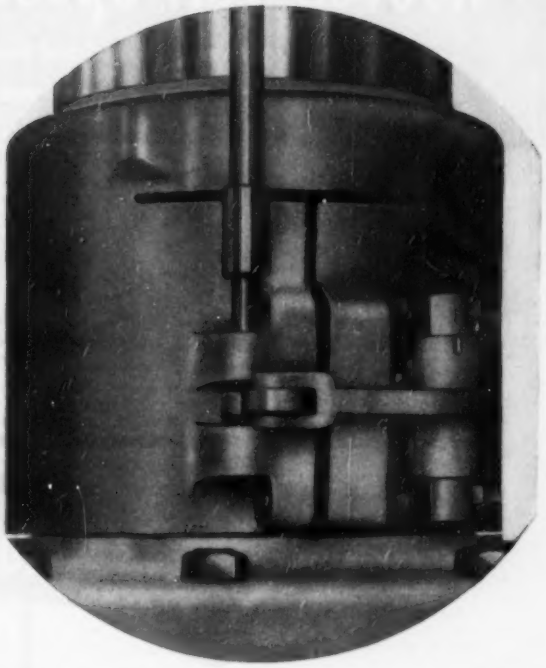
THE GISHOLT ROUND TABLE *represents the collective experience of specialists in the machining, surface finishing and balancing of round and partly round parts. Your problems are welcomed here.*

TRIED *and* TRUE

Now, powerful hydraulic arm and column clamping, operated by push buttons at the head, is standard, available on ALL Super Service Radials having column diameters from 11" to 26", inclusive.

This new feature on the smaller radial drills has been applied after many years of development plus 10 years of use on the large 22" and 26" diameter column machines which necessitate the most effective and powerful clamping that can be devised.

Step saving controls, all centralized on the SUPER SERVICE "clearview" head decrease machine handling time and increase accuracy and production.



Equal Efficiency of Every Unit Makes the Balanced Machine

Column clamping mechanisms are many and varied in design, but no other assures maximum power and effectiveness by providing;

1. The double draw bolt acting on hardened eccentrics.
2. Simple trouble proof hydaulically actuated clamp.
3. Push button controlled at the head on all of the SUPER SERVICE radial drills from the 11" diameter column to the 26" diameter column machines inclusive.
4. Uninterrupted column sleeve clamping surface is an integral part of the column sleeve, permitting stronger sleeve construction.
5. Stress proof column sleeve clamping area.
6. Less movement to the arm when clamp is actuated.

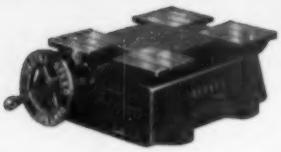
For further information on the distinctly superior engineering features of the SUPER SERVICE radial, write for booklet R-29 covering the 11" to 19" diameter column machines, and Booklet R-22 on the 22" and 26" diameter column machines.

RADIAL AND UPRIGHT SUPER SERVICE DRILLING MACHINES

THE CINCINNATI BICKFORD TOOL CO. Cincinnati 9, Ohio U.S.A.

Reeves Vari-Speed Motor Pulley

converts any standard constant speed motor to a low-cost stepless variable speed drive . . .

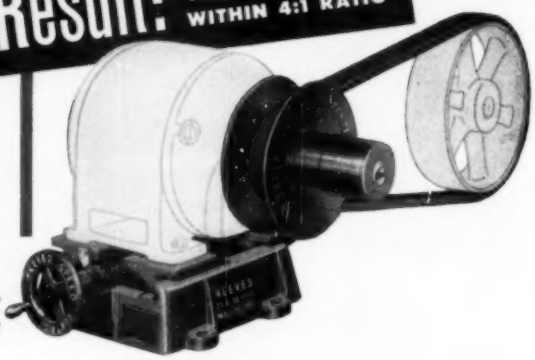


1. REEVES Motor Base provides sliding platform for motor. Handwheel or push-button control increases transmitted speed by moving motor toward driven machine, decreases speed by reversing the operation.

2. Disc Assembly connects directly to motor shaft. Assembly consists of two facing cone-shaped discs—one sliding laterally—and compression spring for mounting on motor extension shaft.

3. Special V-Belt hooks up unit with driven machine. Belt fits between discs and over pulley on power input shaft of driven machine. Belt is adjusted to minimum center.

Result: INFINITELY VARIABLE SPEED WITHIN 4:1 RATIO



Unit instantly delivers any desired speed over entire range and maintains that speed without fluctuating even a fraction of an rpm.

The REEVES Vari-Speed Motor Pulley is the easiest, lowest-cost method of converting a machine with fixed speeds into a highly versatile unit of infinitely variable speed adjustability. Thus equipped, it can handle a wider range of work, better, faster and more economically, because machine speed can be changed instantly and accurately—without shutdowns—to meet the needs of every operation and every operator, *under every changing condition.*

This REEVES unit forms the actual driving element between motor and driven shaft . . . eliminates all auxiliary equipment such as chain drives, gears, belts, etc., . . . requires virtually no more space for installation than any standard belt or chain drive. It is built in eleven sizes, transmitting from ⅛ to 15 hp. over speed ratios from 2¼:1 to 4:1, inclusive.

The complete line of REEVES Speed Control equipment also includes two other basic units, the Variable Speed Transmission and the Motodrive, which are offered in the widest selection of designs, sizes, capacities and speed ratios—with handwheel, push-button or entirely automatic controls.

REEVES units have proved their ability to speed production, cut cost and increase profit in more than 260,000 widely diversified industrial applications . . . are listed as standard equipment on over 2,100 different makes of modern machines.

An experienced REEVES Speed Control specialist will be glad to work with you in selecting the units best suited to your needs. Write today, arranging an interview, and ask for the comprehensive 132-page catalog A7a-3N.

REEVES PULLEY COMPANY • COLUMBUS, INDIANA

Recognized Leader in the Specialized Field of Speed Control Engineering

ACCURATE • VARIABLE

Reeves Speed Control

GIVES THE RIGHT SPEED FOR EVERY JOB!

SPOT NEWS of Metalworking

- **New thermosetting plastic for manufacture of high-strength gears** has been developed by United States Rubber Co. Known as "Enrup," material is reported especially suitable for gears for heavy-duty lathes, household appliances, plating barrels, automotive timing devices. Other applications: fuel pump parts, dies and jigs, valve seats, bearings, tote boxes, various automotive parts. "Enrup" can be produced in wide range, from elastic soft rubber to brittle hard rubber, is resistant to abrasion and chemicals, is very tough.

- **Commercial method of producing electrodeposits of cobalt or nickel** alloyed with as much as 15% phosphorus has been devised by National Bureau of Standards. The new phosphorus alloys are more easily deposited than chromium, are very hard, corrosion resistant and bright. They can be substituted for many chrome-plated applications to get hard, resistant surface or decorative finish.

- **Spanish motor car building company, backed by Fiat of Italy,** is being formed to make 10,000 cars a year at new factory to be erected in free zone of port of Barcelona. Fiat will supply patents and technical management. Fiat (and Alfa Romeo) intend to construct automobile factories in Brazil.

- **"Heavy Iron." new sintered powdered metal product,** is being made by midwest company and shipped to Switzerland, where watch makers are using it for automatic winding watches. Material is reported 2.3 times as heavy as ordinary cast iron.

Pensions which may exceed $150 a month for some workers were granted by A. E. Staley Manufacturing Co., Decatur, Ill., in a new five-year contract with AFL automobile workers. Company says they are most liberal in any industry and $10 higher than pensions recently granted by Budd Co.

- **Pontiac cars will have torque converter and planetary gear set** in their 1951 automatic transmissions, according to Detroit reports.

- **Big power company is locating new offices and control at center of 100-mile radius** encompassing all its properties. Communication with all power plants, reading of meters and control of switches at remote stations will be controlled by ultra short wave transmission (radar) from central office. Only one channel, over which 225 communications can be sent simultaneously, is used.

- **Norton Co., together with Anglo-American Corp. and local companies,** has formed South African company (Norton Abrasives (S.A.) (Pty) Limited) to manufacture abrasives and grinding wheels at new factory at Kempton Park near Johannesburg. Special machinery will be imported from U. S. Norton will send works manager and nucleus of key men to start plant and train South Africans.

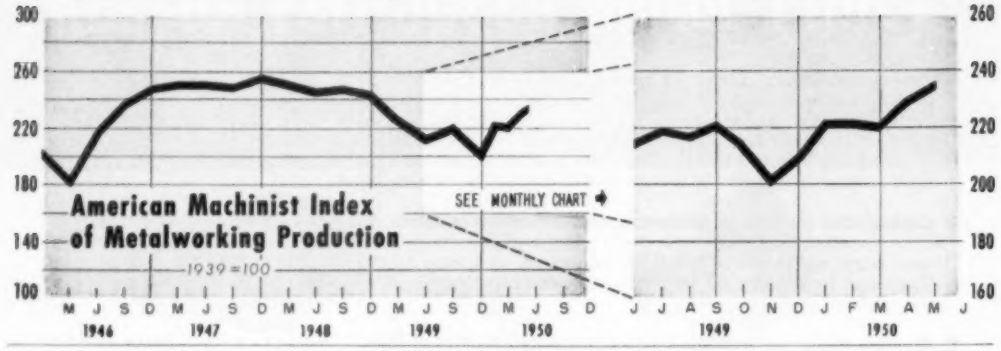
Fiat may take over production of the Scandia, DC-3 replacement transport of Svenska Aeroplan AB, Sweden. SAAB can't make planes fast enough to get sales because of labor-plant capacity bottleneck. SAAB needs, and can't get in Sweden, 1000 more workers; Fiat has plenty of workers, but no design for a first class twin engine transport.

- **Element of human error in stop-watch timing of time studies** on machine operations is removed by automatic statistical recorder designed and developed by F. G. Hyland, H. O. Davidson and professor C. F. Weimer of Ohio State University.

- **UAW idea of area-wide pension plan at Toledo has blown up.** Number of metalworking companies have made contracts with union providing for own pension plans without reference to area-wide program.

- **Many small sheet and strip steel users are being forced to bid for tonnage** wherever they can get it because they are unable to get requirements direct from mills. One lot of sheets is reported to have changed hands at $210 a ton.

Gaging Metalworking



Metalworking Rate Keeps Climbing Steadily

Metalworking rate has been climbing steadily since November. It is likely to rise further in June. That is what study of American Machinist's Index of Metalworking Production reveals.

The index in November stood at 203. By March it had gone to 220. In May it is estimated to have been 235. This month it may go to 240. Only in two months of 1949, January and February, did it get so high. But it still is below 1948 (245 was lowest the index dipped that year).

It is hard to find any segment of metalworking which is "dragging its feet" at present. There has been a general firming up during the spring. Confidence in third and even fourth quarter is strong. Management spirit is buoyant.

Automobiles and construction give no sign of a letdown in near future. Railroad car building has made a notable comeback, largely on basis of Equitable Life's car-leasing plan.

Freight-car builders, in certain cases, are booked into 1951 (steel being the bottle-neck). Pennsylvania Railroad's 10,000-car order did the trick.

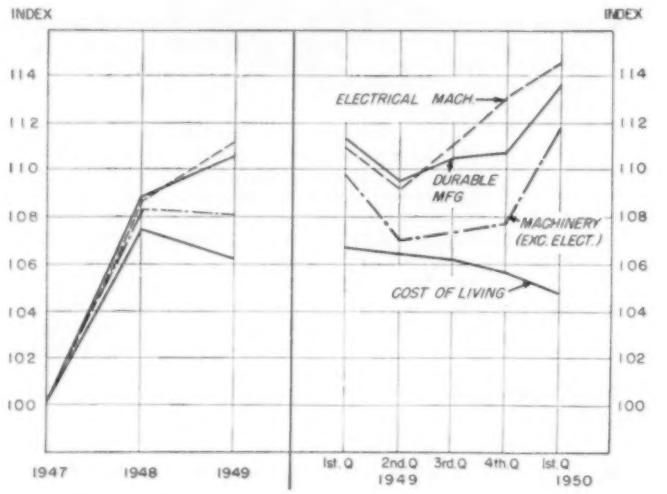
• • •

Manufacture of turbines and other heavy electrical equipment continues at full capacity. Heat is off, however, on deliveries. Utilities are satisfied with easier schedules on installations.

Production of other electrical products—transformers, switchgear, fractional motors—is booming.

Weekly Earnings Up in '50, Cost of Living Down

		WEEKLY EARNINGS		
	COST OF LIVING	Durables	Elect. Machy.	Machy. exc. Elect.
1947	100	100	100	100
1948	107.5	108.9	108.6	108.3
1949	106	110.6	111.1	108.1
1949				
1st Q.	106.7	113.3	110.9	109.8
2nd Q.	106.5	109.4	109.1	107.0
3rd Q.	106.2	110.5	110.9	107.3
4th Q.	105.7	110.7	113.1	107.8
1950				
1st Q.	104.8	113.6	114.6	111.8



SOURCE: U.S. BUREAU OF LABOR STATISTICS

INDEX

	MAY '50	APR '50(p)	MAR '50(r)	APR '49
	235*	**229**	**220**	**222**
Machinery		**220**	**213**	**220**
Electrical Manufacturing		**276**	**258**	**241**
Automobiles, Trucks		**200**	**195**	**193**
Transportation Equipment		**213**	**210**	**243**
Other Metalworking		**244**	**242**	**230**

AMERICAN MACHINIST'S INDEX OF METALWORKING PRODUCTION is based on manhours worked in the five components above.

*Estimated (p) Preliminary (r) Revised

Screw machine products industry is looking up. Prospects are that at end of third quarter volume for the year will be within 3% of last year, whereas it was down 10% in January-March period.

Most producers of screw machine products see this year's total equal to 1949's (last year was only fair). Delivery is of such importance currently that customers are not shopping around much for lower prices.

• • •

Foundry people—gray iron, malleable, steel—are viewing balance of year with optimism. Operations have risen to 65% overall, a nice gain over first-of-the-year rate. One shift prevails, but in few cases a six-day week is in effect.

Gray iron foundries are short on backlog, with hand-to-mouth buying the practice. Orders are from wide range of customers, however.

Malleable and steel founders expect releases from railroad car builders the next few weeks. Malleable foundries in particular are profiting from high automotive output, as well as from general improvement in demand.

New all-time record for steel production was chalked up in May, preliminary figures show. No interruption to continuous operation departments was permitted because of Memorial Day holiday; and most finishing departments worked through the day.

Most steel companies have been running well in excess of 100%. Mills in Youngstown district, for example, are at 106%. This extraordinary situation is likely to hold during June.

Third quarter looms stronger than ever to steel officials. All-out production of motor cars keeps flat-rolled steel very tight. No relief is anticipated until fall, if then.

• • •

Industrial production may well hit a new postwar peak in June, according to word from Washington. Unofficial estimates put the Federal Reserve Index of Production at 196 for the month. Previous high, late in 1948, was 195.

Reasons: (1) June is likely to break all records for automotive production; (2) appliance output is zooming along at peak volume; (3) industrial machinery business of almost all kinds still is expanding; (4) heavy construction awards are 44% ahead of 1949 and homebuilders are starting new units at rate of 1.25 million a year.

• • •

Export prospects for industrial machinery in general are brightening. Up to now, shipments abroad have been lagging 15% behind last year. Explanation is that United Kingdom, ECA nations and other sterling area countries have cut back sharply their buying to save dollars. The same goes for Latin American countries.

• • •

Sales of gearing industry were down 8.3% in April compared with March. Index of American Gear Manufacturers Association was 328.6 (1935-1936 = 100).

WEEKLY BUSINESS INDICATORS

	Latest Week	Preceding Week	Year Ago
Business Week index of activity (1923-1925 = 100)*	209.6	207.4	186.2
Steel ingot operations (% of capacity)	101.5	101.8	91.8
Electric power output (million kilowatt-hours)	5,894	5,845	5,270
Production of automobiles and trucks	183,630	175,314	117,703
Engineering construction awards (Eng. News-Record; millions)	$206.5	$291.2	$123.1

QUARTERLY BUSINESS INDICATORS

	Latest Quarter	Preceding Quarter	Year Ago
Gross national product* (annual rate, in billions)	$263.9	$256.7	$262.0
New plant and equipment expenditures, all industry (in millions)	$4,110[1]	$4,630	$4,460
Profits after taxes in primary iron and steel industry (in millions)	$107[2]	$138	$288
Profits after taxes in fabricated metal products (in millions)	$87[2]	$105	$145
Profits after taxes in machinery industry (in millions)	$163[2]	$181	$254
Profits after taxes in electrical machinery industry (in millions)	$149[2]	$78	$121
Profits after taxes in motor vehicles and parts industry (in millions)	$269[2]	$367	$267
Motors and generators, new orders index (1936 = 109)	338	236	262

*Seasonally adjusted
[1]Estimate based on anticipated capital expenditures of business
[2]Fourth quarter, 1949 data.

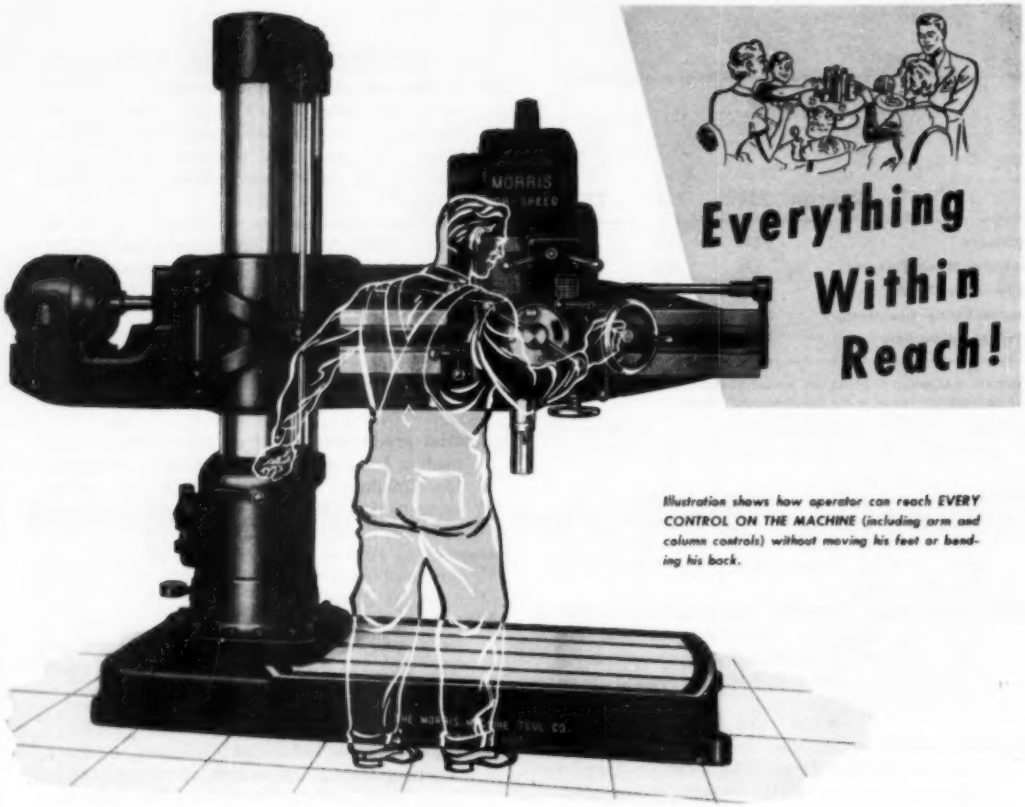


Illustration shows how operator can reach EVERY CONTROL ON THE MACHINE (including arm and column controls) without moving his feet or bending his back.

Designed to set a cost-killing pace in the race for profitable production, the MORRIS MOR-SPEED Radial Drill offers a long series of outstanding features:

- **Centralized controls—reduces time between cuts.**
- **Variety of Speeds and Feeds—better selection of the right combination for job at hand.**
- **Automatic Lubrication—prevents damage and saves wear.**
- **Greater strength, rigidity and balance—provides greater machining precision.**
- **More automatic steps—saves time and reduces manual control.**

If you are interested in removing metal faster, with greater precision and at less cost, investigate MORRIS "MOR-SPEED" Radial Drills.

Write for copy of new Bulletin 239-A.

THE MORRIS MACHINE TOOL COMPANY

"A better product at less cost— with MORRIS ENGINEERED PRODUCTION"

Builders of MOR-SPEED Line

933 HARRIET STREET CINCINNATI 3, OHIO

American Machinist

MAGAZINE OF METALWORKING PRODUCTION ★ ESTABLISHED 1877

The Machine Wins a Convert

The new five-year contract of General Motors with the United Automobile Workers contains a revolutionary feature largely overlooked by the press. The union clearly acknowledges in it that the machine is the friend rather than the enemy of the worker.

As in the former contract, the new one provides for an "annual improvement factor." It stipulates that four cents an hour shall be added annually to the base hourly rate of each factory employee as his share of savings accruing from new mechanical processes.

In short, it rewards the worker each year for an anticipated gain in productivity per manhour. That gain will be only a myth, however, unless the worker himself helps. It is sure to be washed out if the machine operator refuses to turn out maximum production of which new machines are capable.

THE NEW CONTRACT comes to grips with this issue. This clause has been inserted:

"The annual improvement factor provided herein recognizes that a continuing improvement in the standard of living of employees depends upon technological progress, better tools, methods, processes and equipment, and *a cooperative attitude on the part of all parties in such progress.* It further recognizes the principle that to produce more with the same amount of human effort is a sound economic and social objective."

Read that clause again. It marks a new and refreshing attitude by unions toward the rapidly growing mechanization of industry.

Gone is the turn-back-the-clock approach of union leaders like the musicians' Petrillo and the railroad firemen's Robertson, who would extend the indefensible "featherbedding" principle. Gone is the archaic thinking of Philip Murray, who proclaimed recently that "labor is not going to sit idly by and permit widespread introduction of machines to starve it to death."

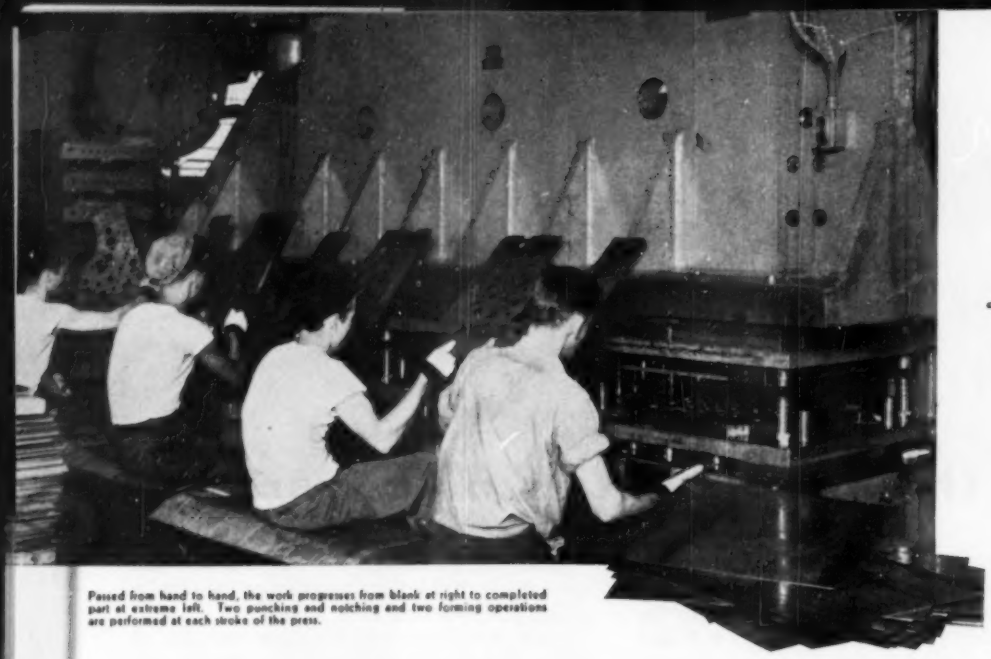
THE UAW'S PRESIDENT Walter Reuther is subscribing instead to the doctrine that the machine and the worker are allies. He is admitting in a five-year contract with the biggest employer in his industry that improvement in our standard of living comes from use of better tools, better methods, better processes, and better equipment.

What is more, he agrees that a cooperative attitude by employees is part and parcel of technological progress. Without it, the machine's benefits cannot be realized. And the worker himself then is the sufferer along with the nation.

We congratulate Mr. Reuther on his foresight. We sincerely hope that his members will carry out both the letter and the spirit of this agreement. We hope that other labor officials will follow his example.

For increased productivity, year by year, is the foundation upon which we can expect to build an even higher standard of living.

Burnham Finney



Passed from hand to hand, the work progresses from blank at right to completed part at extreme left. Two punching and notching and two forming operations are performed at each stroke of the press.

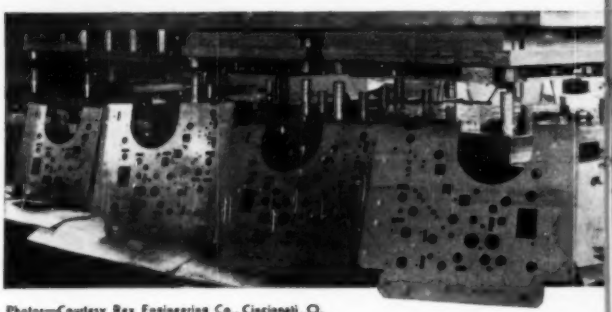
OPERATION TELEVISION...

This television chassis, a modern product made in the modern manner on a Cincinnati Press Brake, is produced from blank to completion in one stroke—four simultaneous operations on one machine.

281 holes, tabs and notches are punched, and three sides are formed at each stroke—to close tolerances.

Cincinnati wide beds and rams—either fixed or detachable—for large area work, are highly productive on jobs of this kind.

You may find you can do it for less on a Cincinnati Press Brake.



Photos—Courtesy Rex Engineering Co., Cincinnati, O.

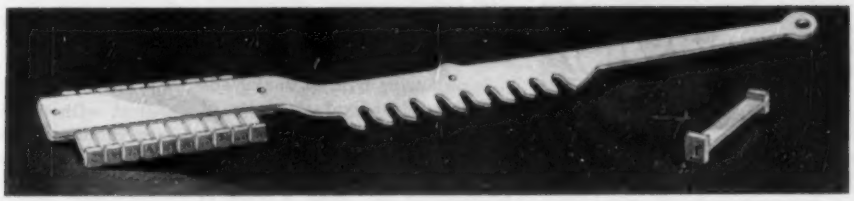
Write for technical Bulletin 135 a compact treatise on Press Brake practice, dies and applications.

THE CINCINNATI SHAPER CO.

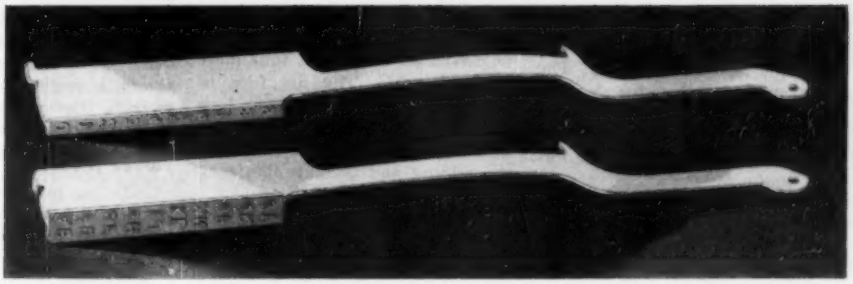
CINCINNATI 25, OHIO U.S.A.

SHAPERS · SHEARS · BRAKES

Kneading Produces The Type In This Assembly . . .



. . . But Characters On These Type Bars Are Coined



Precision characters on type bars in Monroe adding and bookkeeping machines are produced by two major methods, coining and kneading. Coining forms all characters on single-piece bar in two operations and is method for lowest cost. In kneading, characters are formed on each slug of type individually in special machine built at Monroe. Process is very flexible and has low tooling costs

KNEADING AND COINING MAKE ACCURATE TYPE CHARACTERS

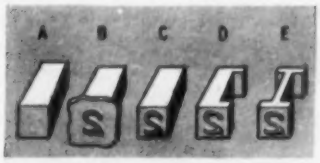
These two methods form a production team that has speed and flexibility in operations involving the controlled flow of cold metals to close limits. Related operations also are tooled for low cost on close-tolerance work

BY T. G. FALSTROM, Chief Tool Engineer, MONROE CALCULATING MACHINE CO., ORANGE, N. J.

INFORMATION recorded by adding and bookkeeping machines must be clear and distinct—legible beyond question and correctly aligned on the record form. Characters on all type bars, therefore, must be completely formed, accurately positioned on the bar, and of uniform height and fullness throughout their contour. At the same time, as these machines sell in a competitive market, everything must be done to hold cost to the minimum. And this must be done despite the fact that many orders are for small quantities, while others specify special characters on the type bar. To turn out quality work at low cost under these conditions, we have adopted kneading and coining as our major methods of producing type or type characters.

Coining is the faster of the two methods and is employed for those models on which production is the highest. The coined type bar is a single piece produced entirely by stamping operations. Aluminum is specified at the present time, but results are equally good on steel. Whenever production quanti-

KNEADING PROCESS Involves Milling, Broaching, Welding



Type development shows steps in making type by the kneading process: A, cut off and tumbled; B, kneaded; C, trimmed; D and E, milled. Part then is burred and hardened

ties justify the cost of dies, coining is the preferred method: The coined type bar has fewer parts and operations, with consequently lower labor and material costs; requires less productive equipment; and results in a shorter manufacturing cycle and lower work-in-process inventory.

Kneading, on the other hand, is an extremely flexible method of production and is well adapted to a large number of orders in which unit quantities are relatively small or on which special characters are required. Kneading produces characters on individual slugs of type, which then are assembled in any desired combination with two other parts—a slotted type bar and a grooved guide plate. Kneading machines can be changed over from one character to another in as little as five minutes and single-character dies cost only $10. At the same time, the characters are of excellent quality and their location on the type face can be held within 0.0005 in.

Kneading is not a new process, having been patented in 1906 by R. C. Vetter. However, the Monroe machine, which was built many years later in our toolroom, contains numerous improvements over the older machine.

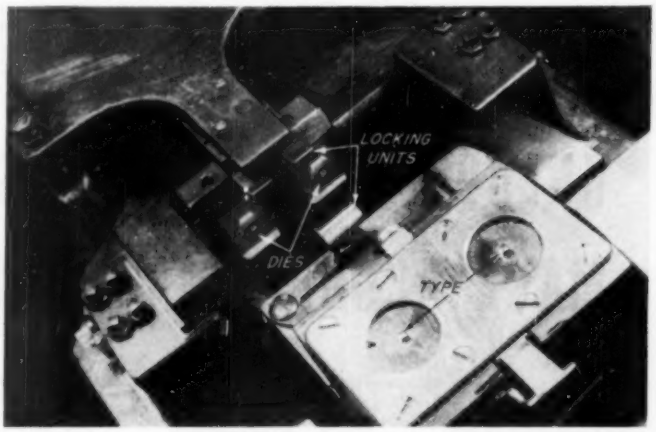
Kneading Dies

In producing type by the kneading process, individual pieces of type steel are brought under pressure against dies that rock continuously through an angle of approximately 20° about a point in the center of the die face. The dies are of 5/8-in.-dia drill rod, engraved and hardened. Dies are 3 in. long and have characters engraved on both ends, thus doubling die life. The die face is slightly convex, as the type face should be somewhat concave to give full bearing on the platen of the adding and bookkeeping machines.

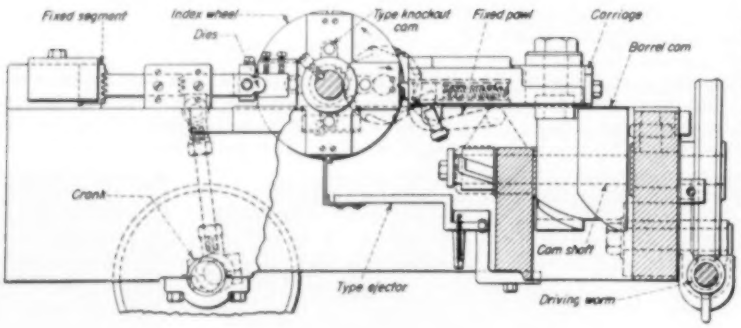
Slugs of type are placed, two pieces at a time, in fixtures held in a four-position indexing turret. At the second position the turret advances for the kneading operation. Just prior to kneading, a special locking device closes the fixture to grip the slugs securely. Advance is rapid to the point of contact with the dies. The turret then continues forward at a slow rate for approximately 1/32 in. During this travel, the characters are formed. Withdrawal again is rapid. All traverse motions of the turret are controlled by a barrel cam mounted with axis parallel to the bed of the machine. The cam cycle is the same for all characters, requiring a total of three seconds. The production standard is 960 pieces per hr.

Turret Indexing

Indexing is accomplished by a ratchet that engages a stationary pawl on the machine frame as the turret withdraws. A locking pin



Kneading dies are visible below spring-mounted locking unit. This unit acts with that on turret to lock and release type in fixture as turret advances and returns



Kneading machine has crank mechanism to rock plates in which dies are held. Spring-loaded turret is advanced on machine ways by barrel cam. Indexing is accomplished by ratchet and fixed pawl. Special mechanism for locking type slugs in turret fixtures is not shown. Fixed cam surfaces on machine frame actuate knockout cams in turret to eject type partially. Forked arm in third position completes ejection into pan below machine

on the index wheel of the turret is retracted automatically and rides the surface of the index wheel until it enters the next slot in the wheel, thus locking the turret as the next station comes into position for kneading.

As the turret withdraws from the kneading dies, the special locking device opens the turret fixtures. Then, during indexing, a cam surface on the machine frame actuates a cam bar in the turret to cause two pushrods to force the type partially from the turret. At the next position, a swinging forked arm engages the type under the flash, pulls it clear of the fixture, and drops it in a chute to pans under the machines. The chutes are separate and lead to separate pans, so different characters can be kneaded simultaneously without danger of mixing.

Requirements for Accuracy

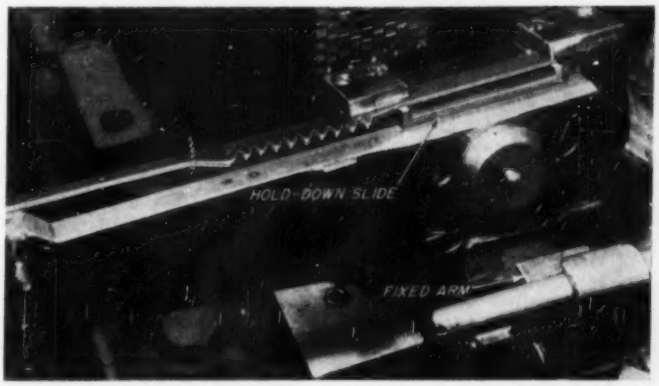
Type stock is ⅛-in. square commercial cold-drawn steel which should be approximately 90 R_B and should not exceed 105 R_B as a top limit. If stock is outside this range, it is difficult to trim the flash from the kneaded piece. After cutoff in a screw machine, slugs are tumbled before delivery to the kneading machine. In the cutoff operation, the stock is given a 7/32-in. radius. This "doming" is necessary for good metal flow during the kneading operation. The center area of the character is formed first and metal then flows to the outer extremities of the cavities during the rocking process. The surface of the slugs also must be smooth. The cutoff must be good and tumbling then removes all tool marks. This insures a surface in which a smooth, sharp character, free from defects, can be kneaded.

The fixtures in the turret are hardened and precision ground to close tolerances both in the nesting section and on the over-all length. The accuracy of the location of the character on the type and the fullness of the contour depends to a large extent upon the fixture. Both ends are ground and as wear occurs the fixture in one side of the turret can be turned end for end and placed on the other side of the turret. Fixtures also can be reground on one end and shimmed to correct height in the turret. Type-stock dimensions also are important in maintaining kneading accuracy. Stock is selected so cross-sectional dimensions fall between 0.1235 and 0.125 in. During kneading there is a reduction in the over-all length of slug from 0.610 to 0.561 in. in raising a character 0.021 in. high on the slug. The excess metal goes into flash and is trimmed in a small Niagara crank press.

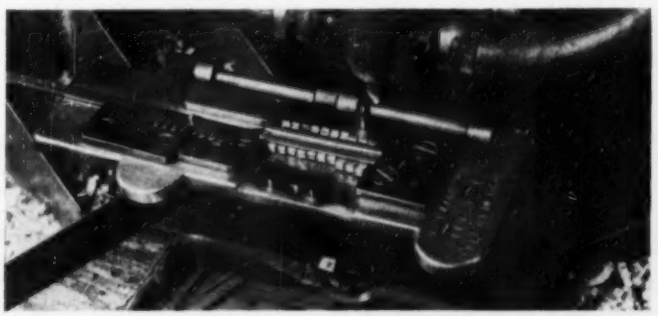
Milling and Burring

Type then is milled in a special Cincinnati milling machine that is well adapted to a high-production setup. Four milling heads on one base are driven from a central hydraulic system; the cycle is automatic and one operator can tend four heads. Quick-acting fixtures hold two slugs at once. After the first cut each slug is turned over and placed in the other side of the fixture for milling to shape on the reverse side. Cutters are spe-

Type bar has close tolerances on slot dimensions and all slots have same requirements. Material is CRS hard grade

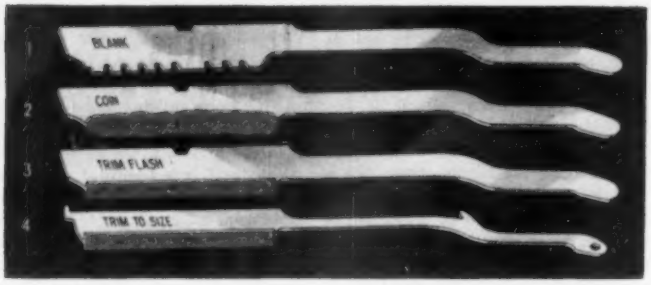


Broaching produces ten slots in type bar in one pass on ½-ton Colonial broaching machine. As hinged fixture is swung back, button strikes fixed arm causing hold-down slide to withdraw for removal of type bar

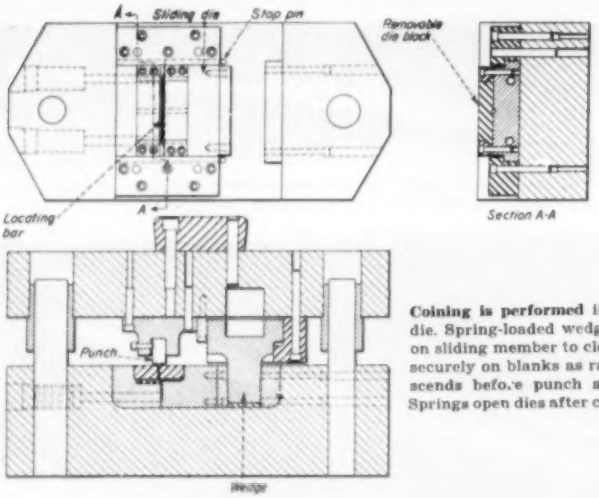


Spotwelding of guide plate to type bar is done on Weldex machine with automatic cycle. Hinged fixture slides along bar between two welding positions

COINING PROCESS Keeps All Operations on Presses



Coined type bar is blanked oversize, then trimmed to drawing dimensions after final stamping operation. Notch locates blank during coining and trimming



Coining is performed in split die. Spring-loaded wedge acts on sliding member to close die securely on blanks as ram descends before punch strikes. Springs open dies after coining

cial form cutters by Pratt & Whitney with staggered teeth and with alternate teeth ground to a reverse helix angle to eliminate chatter and vibration.

After milling, burrs are removed in a special setup in which a fixture holding one slug is moved by air cylinder beneath a stationary broaching tool. Stepped cutting teeth remove all burrs in a single pass. During the cutting stroke, the fixture moves past a swing finger at the end of the broaching tool. This drops behind the part to provide automatic ejection as the fixture returns to the loading position. After hardening and a flash cadmium plate, the type then is assembled in the type bar.

Broaching Type Bars

Production of this bar requires a fast, accurate method of producing slots in the bar. The relation of these slots to the pivot point and to each other must be held within close limits to insure good alignment of characters when the adding machine prints the results. For the same reason, and also to insure smooth, trouble-free printing in operation, the slot width must be held within 0.001 in. total tolerance.

Initially, slots were gang-milled five at a time in a two-position fixture. After the first five slots were milled, the fixture was shifted and the second group of five were cut. However, as only 0.019 in. of stock remains after slotting, it was difficult to hold the bar securely to obtain the smooth surface required for proper operation of the type. The solution to this problem is the broaching setup pictured.

The part locates from the pivot hole and rests on a 0.015-in. step in the fixture. A hold-down slide positions the part firmly against the step and the fixture then is rotated 90° into the broaching position. After broaching, as the fixture is swung back to the loading position, a button strikes a stationary arm on the fixture causing the hold-down slide to retract for removal of the completed part.

The broach is of Monroe design with ten separate blades having staggered teeth and steps for removing burrs on the ridges between slots. This feature eliminated much of the burring that was necessary in the old method and means not only an appreciable saving in time but also a big improvement in quality. Burring now is positive and precise. On the average, about 33,000 parts per grind are obtained from each broach.

Hard stock is specified for the type bar. As the step on which bars rest is only 0.015 in. wide, the stamping must be flat so maximum support can be obtained against the broaching thrust. Our experience shows that hard stock gives flatter blanks from the press operations. So in this case, hard stock is specified to give better processing.

Assembly of Type

Type bars and type are assembled and spotwelded at a work place set up in accordance with good motion-economy principles. Using both hands simultaneously, the operator gets type from individual bins lined up on each side of the fixture. Type is assembled from the center to the outer slots and characters are placed in adjacent bins according to this sequence. Positioning type can be done by feel without looking at each piece as the type is not symmetrical in shape.

The guide bar is spotwelded to the type bar in a two-position fixture. Following the first spotweld the fixture is pivoted a few degrees around one edge to clear a locating pin, then slid along a bar to a second position. Spotwelding is done in an 8-kva Weldex machine with automatic cycle and foot-switch control. Pressure, heat,

and time are adjustable, and are preset to values that give a good weld in minimum time. If the pressure fails to reach the value that has been found necessary to hold the pieces together, the machine will not fire. As all variables are under the control of the machine, uniform quality is assured.

Coining Operations

The single-piece type bar is made complete in five operations. The first operation produces blanks from strip stock in the conventional manner. Development of the blank form, however, required considerable experimentation. The notched section of the blank is the part on which the characters are formed. It was necessary, therefore, to determine the notched dimensions very closely to provide the right amount of material for filling to width and for producing sharp characters in the coining operation. From a blank that is 0.050 in. thick, sufficient stock must be upset to produce a flat which, for a single or double row of characters, is 0.124 in. wide. Characters then must be raised to 0.021 in. above this surface. It was found necessary to allow 0.125 in. of stock width for this flow, the blank width going from 0.860 in. before coining to 0.735 in. after the operation. The blank also is oversize all around to accommodate a locating notch in the oversize section. In the coining and flash trimming operations, location is from this notch. The bar then is trimmed to exact size in the final operation.

Coining is done in two operations. The first produces a character with an included angle of 67° and a height of 0.031 in.; contour dimensions, otherwise, are exactly as required in a finished bar. As each lot is completed, the punch is changed, and the part is put back in the same die for the second coining. The second punch contains cavities with an included angle of 82° and a depth of 0.021 in. The blunter angle and reduced character height causes a flow of metal that completely fills all cavities in the dies, producing sharp characters that are full throughout their contour.

During coining, that section of the blank in which no change of section is permitted, must be held securely. This is accomplished by split dies. To avoid the cost of a double-acting press, these are actuated by a wedge. Attached to the press ram is a spring-loaded arm that operates against the wedge as the ram descends and closes the dies just prior to the coining operation. Further travel of the ram, as it bottoms in the dies, is taken up in the spring. Coining is performed on a #4 Niagara crank press with 4-in. stroke and bars are produced at more than 400 pieces per hour. This standard includes placing bars in special racks to prevent damage in handling.

As the type bars are made with several different character combinations, it was necessary to provide for quick interchangeability of punches in the coining operation. Only two setscrews must be loosened to remove the punch. Dies, too, are readily removable so bars of different width steps can be coined.

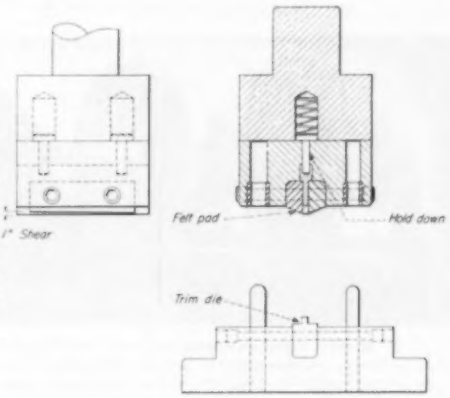
Coining punches require careful engraving and all cavities must be free from scratches and blemishes. Characters of smooth, even surface cannot be produced unless the punch is of good quality. Our experience has shown, too, that punches must be made with grain running from top to bottom, otherwise swelling occurs in the punch during a production run.

Trimming Dies

Following the second coining operation, flash is trimmed from the bar. Location again is from the notch and a spring-loaded pad in the ram descends first, to contact the bar and hold it firmly in place during the operation. A felt strip on the pad prevents damages or scratches on the characters. As the die sections on which the trimming occurs are only 0.0225 in. wide, it was necessary to reduce the pressure of these sections to a minimum to avoid shock and excessive wear. This was done by grinding a 1° shear angle in the trimming punch. This method accomplishes the desired result and the die has worked out very well in operation.

The final operation trims the bar to exact size all around. In this operation a spring-loaded plunger presses the piece against two stops that locate between the 0-1 and 8-9 characters. The operation is inverted in that the die section is in the ram and the punch is stationary in the die set.

Coining is working out very successfully on the standard single-row character bars for our adding machines and also on specials up to three characters across that require a 0.174-in.-wide face. On these, blank stock still is 0.050 in. thick, but the blank width is increased to 0.940 in. to provide the extra stock required for this greater flow of metal. Once this width was determined, we experienced no trouble in producing three rows of characters that are as sharp and precise as when only one row is attempted.



Flash-trimming die has 1° shear on punch to reduce shock on die that must be of small cross-section. Bracket on front of die (not shown) helps in placing type bar horizontal for operation. Felt pad on hold-down avoids damage to characters during operation

WHICH POWER SOURCE FOR PLATING?

BY E. G. SCHROEDER, THE ELECTRIC PRODUCTS CO., CLEVELAND

ELECTRIC POWER is the heart of the plating operation. It controls the operating continuity of an investment many times greater than itself, and any part of an operation that is so critical to the continuity of the operation as a whole deserves the most careful consideration in its application and use.

The oldest, and time-proved, power source of the plating industry is the heavy-duty motor-generator set. It dates back to the beginning of the industry and enjoys the reputation of being the most reliable source of electric power.

The selenium rectifier was introduced in Europe many years ago, and several other types of dry-plate rectifiers have been available in this country. They did not gain a sizable foothold in the electroplating industry prior to World War II, because of the excellent reputation that m-g sets had built over the years. Many claims were made for rectifiers but no operating installations of any consequence could be shown to demonstrate and prove the points claimed for them.

During the last war, the electroplating industry really came of age. Generator manufacturing capacity was taxed to the limit. Under these conditions, the rectifier succeeded in entering this market, and it contributed greatly to the war effort. During the postwar period, generator manufacturers were still unable to meet the demand, opening the way for more and more rectifiers into the electroplating industry.

Unfortunately, as is usually the case under extreme emergency conditions, the rectifier was misapplied in as many or more places than it was applied properly. This misapplication has carried over into present practice. However, experience gained during the war years and the immediate postwar emergency period demonstrated that there is a definite place for the rectifier in electroplating.

To determine whether an m-g set or a rectifier should be used as the power source involves the evaluation of seven major factors: (1) Initial Cost, (2) Voltage Regulation, (3) Operating Efficiency, (4) Power Factor, (5) Mounting Space Required, (6) Installation Costs, (7) Flexibility.

Initial Cost

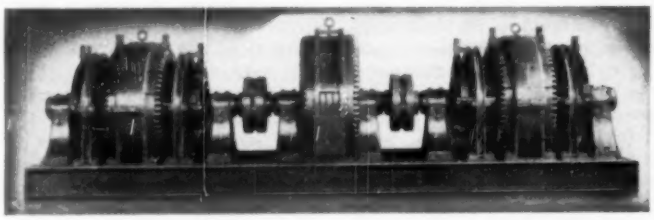
The largest single factor in favor of the rectifier is its lower cost in the smaller ampere capacities. However, the first cost of the equipment is dependent upon the load curve of the particular plating operation.

Suppose the load curve looks like that shown in the accompanying illustration. The short-time overload between points A and B could be handled safely by a rectifier, but not the one shown between points C and D. A rectifier is suitable for short-time overloads, but not for continuing overloads. If no overloads exceed the one indicated between points A and B, a 1500-amp rectifier would be more economical than an m-g set, for this particular operation.

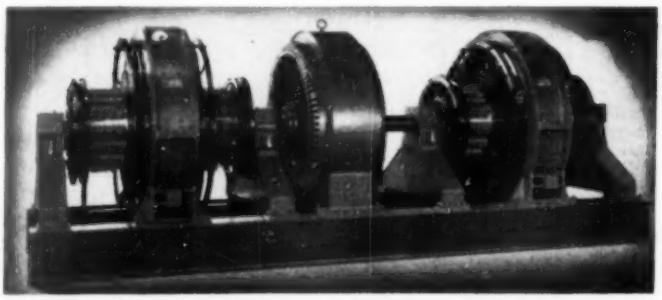
However, if the overloads are of the nature indicated by the curve between points C and D, the rating of the rectifier would have to be increased to the peak rating of the long-period overload. This would mean 1800 amp or a standard 2000-amp rectifier. But, because of the inherent overload capacity of the m-g set, a 1500-amp set would be entirely satisfactory and a better proposition.

Voltage Regulation

The inherent voltage regulation of any rectifier is relatively poor



Old-style motor-generator set with each generator rated at 6000 amp at 6 v. Note massive construction with liberal use of cast iron, and the general inaccessibility of the various units for service



Modern motor-generator set with two 7500-amp, 15-v generators, reconnectible to deliver 3750 amp at 30 v. Note easy accessibility and all-welded, fabricated steel construction

Would you drive a modern machine tool from a line shaft—or direct couple it to a steam turbine? Of course not! But perhaps you are doing the same thing with the power for your plating installation. This article will help you to select and apply the right type of power source for electrolytic processes

Selenium electroplating rectifier rated at 2000/1000 amp at 6/12 v. Interior construction features a heavy-duty stack for long, trouble-free service

as compared with an m-g set. This is particularly important because the voltage on the tank directly affects the current density. In cases where the work may burn under excessive current density the voltage must remain as nearly constant as possible, and such cases are natural applications for the m-g set. This is especially true where the load is variable and the operator must be constantly on the alert to see that the voltage is maintained at a constant value.

Operating Efficiency

This is a point of extreme importance as it affects operating costs and is probably given less consideration by the average plater than any other part of the power application problem. Consideration must be given to the total number of kilowatts of power involved before efficiency can be given its proper evaluation. For example, 1000 amp at 6 v represents a dc power output of only 6 kw. Where the power involved is that small, efficiency becomes quite insignificant. Hower, if a larger installation of say 10,000 amp at 9 v is considered, this represents a dc output of 90 kw and efficiency then becomes an important factor.

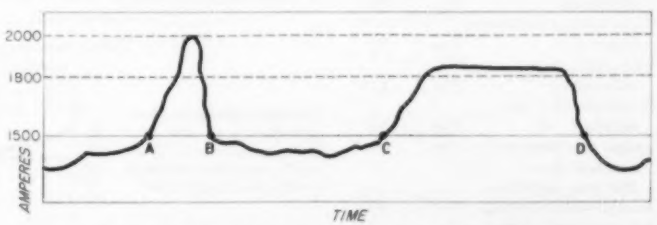
It must be recognized that all rectifiers, regardless of type or make, are subject to aging and consequent loss in efficiency. Despite all claims, no fixed pattern can be set up to determine this exactly. It will vary over extremely wide limits, depending on the way the rectifier is used. Loss in efficiency is a direct function of the total heat to which the units are subjected. This means that two variable conditions are present: the load applied to the rectifiers, and the ambient conditions. In contrast, the m-g set has a definite lifetime efficiency which does not change with age, regardless of operating or ambient conditions of the installation. The larger the installation in terms of kilowatts of power, and the longer the hours of operation per day, the more the installation favors the m-g set. Conversely, smaller amounts of power on a shorter day or intermittent operation favor the rectifier.

An accompanying table indicates the importance of quantity and time in the savings possible through the difference in efficiency. The annual saving of $116 on a 1000-amp, 6-v load on one-shift operation is not particularly significant, but the $4080 saved on a 10,000-amp, 9-v load on two-shift operation means that there is a return of approximately 75% on the difference in investment between m-g sets and rectifiers. Or, to put it another way, the difference in cost will pay out in a little over one year's operation, and from there on, these savings can be realized annually throughout the operating life of the equipment.

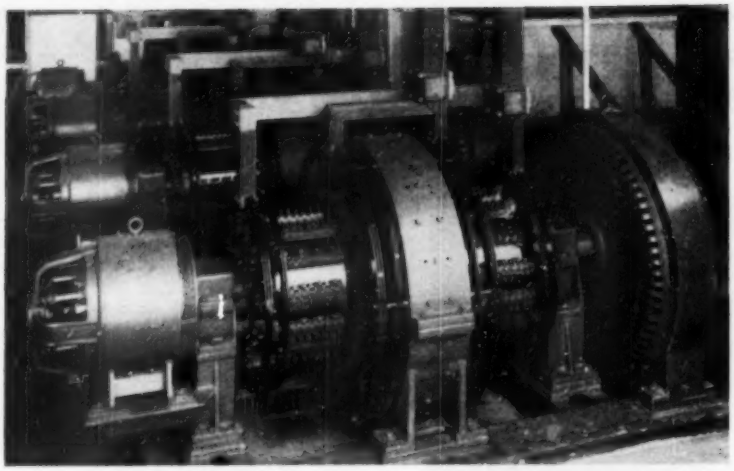
Power Factor

In general, power factor affects the cost of operation because poor power factor generally increases the demand charges of the power company, represents excessive loss of power and overheating of distribution cables within the plant and, in many cases, necessitates rewiring and rearranging the plant because of apparently overloaded cables.

While the rectifier does not operate at poor power factor, it does not contribute to the correction of power factor to compensate for inductive type loads. This is extremely important in the average plating operation because of the many buffing and polishing machines which are driven by induction motors and which operate usually below rated load and at relatively poor power factor. All medium and large electroplating m-g sets are powered by synchronous motors which afford an economical solution to the power factor correction problem. In many cases, this pow-



Load curve for plating installation is a reliable guide in deciding whether a rectifier or an m-g set should be used



Large plating installation rated at 40,000 amp. Each motor-generator set has a full-load rating of 10,000 amp at 9 v

er factor correction consideration alone will return as much as 25% on the capital investment in m-g equipment.

Mounting Space Required

Any space taken by equipment cannot be utilized for production and represents a definite fixed overhead cost. As a general rule, in small amounts of power, the rectifier will mount in a smaller space than the m-g set. As the installation is increased and it is necessary to add a number of rectifier units, this saving disappears. Usually, in ratings above 5000 amp at 6 or 9 v, the m-g set occupies less floor space than a large number of single rectifier units. Certain companies manufacture larger capacity, single rectifier units but these are not standard. They are manufactured to order and represent little savings over the m-g set in the first cost of the equipment.

How Does the Job Affect Choice?

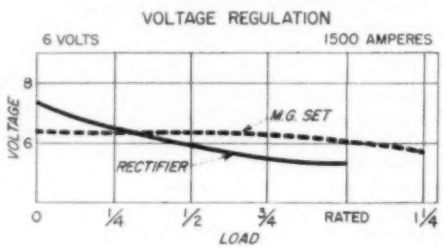
	MOTOR GENERATOR	RECTIFIER
Intermittent duty	No	Yes
Power factor correction	Yes	No
Small ampere ratings	No	Yes
Adverse ambient conditions	Yes	No
Close voltage regulation required	Yes	No
Very short time overloads	Yes	Yes
Overloads of longer duration	Yes	No
Larger kw capacities	Yes	No
6 v and above		
3000 amp and above		
Roof or wall mounting	No	Yes
All automatic plating machines	Yes	No

Installation Costs

As a general statement, a single rectifier unit can be installed more economically than a single m-g set because it is usually recommended that a base be provided for the latter, whereas the former can be set on an uneven floor or mounted on brackets or some other lighter type of construction. However, when it is necessary to install a number of rectifier units, the cost of the base for the m-g set is more than offset by the fact that it is necessary to bring in an individual power line and some type of disconnecting switch to each of the individual rectifier units. Installation and wiring costs increase very materially whereas, in the case of the m-g set, regardless of its size, it is necessary to bring in only one power line and mount one disconnecting switch.

Tying in with the previous consideration of the space factor, it is often necessary to mount equipment in a less advantageous spot because of crowded conditions. For example, it is common practice in smaller shops to mount power equipment on the second floor or on the roof. The amount of floor or roof loading permissible must be considered. Usually the equivalent rectifier capacity will be lighter than the m-g set because the rectifier employs less steel and copper. In certain restricted installations of this type, it is necessary to go to the rectifier unit, despite all other considerations, if it is found that the second floor or the roof is not sufficiently strong to carry the heavy concentrated loading imposed by an m-g set.

The installation of equipment must also be considered a part of its first cost because it is not until the equipment is operating that it is actually ready for service. The



Voltage-regulation characteristics of the m-g set are superior to those of the rectifier and may be the deciding factor

Typical Plating Processes and Equipment Consideration

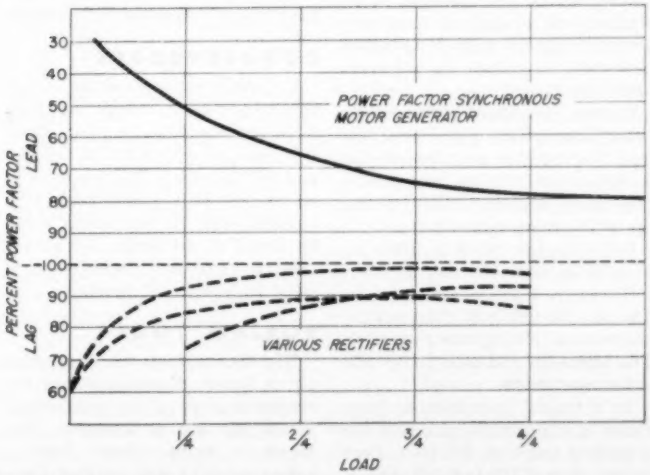
PROCESS	EQUIPMENT	MOTOR GENERATOR	RECTIFIER
COPPER, ACID	Hand tank	No	Yes
	Semi-automatic	Yes	No
	Automatic machine	Yes	No
COPPER, CYANIDE	Hand tank	No	Yes
	Semi-automatic	Above 3000 amp	Below 3000 amp
	Full-automatic	Yes	No
NICKEL	Hand tank (Small)	No	Yes
	Hoist line	Yes	No
	Semi-automatic	Yes	No
	Automatic machine	Yes	No
CHROME	Hand tank	No	Yes
	Hoist line	Yes	No
	Automatic machine	Yes	No
CADMIUM	1 to 3 Barrels	No	Yes
	4 Barrels and above	Yes	No
	Racked parts	Not used extensively . . . usually small setups that favor rectifiers.	
*ZINC, CYANIDE ACID	1 to 2 Barrels (12 v)	No	Yes
	3 Barrels and above (12 v)	Yes	No
	Racked parts:		
	Hand tank	No	Yes
	Semi-automatic	No	Yes
	Full-automatic	Yes	No

* Bright zinc at approximately 100% higher current densities favors m-g sets.

successful operation of a rectifier depends to a much larger extent on its location than does an m-g set.

Rectifier stacks are subject to closing off of the ventilating system where the atmosphere is extremely dirty. The plates are also subject to considerable corrosion and shortened life due to excessive moisture and corrosive fumes. It is recommended that, wherever possible, a rectifier be located separately from the plating setup and ventilated with clean, cool air.

General practice has been to locate the m-g set adjacent to the plating tank. This considerably shortens the bus run and not only cuts down on the cost of copper for installation but also reduces operating power loss in the bus and improves voltage regulation at the tank. While it is to be recognized that any piece of equipment, m-g or rectifier, will have better life if located in a separate room, the effect of adverse ambient condition on the m-g set is much less.



Power-factor correction can be aided by m-g sets. Rectifiers do not operate at poor power factor, but do not improve existing conditions

Flexibility

The question of flexibility is becoming increasingly important with the changing conditions that are always present and becoming more prevalent in the plating industry. The rectifier has the advantage of being immediately available as a standard packaged unit for operation in parallel with another rectifier unit, not necessarily of the same type or ampere capacity, when load conditions change. Partially to offset this is the fact that the m-g is suitable for considerable overload not possible in the rectifier and does provide the margin of safety in its conservative overload ability to provide additional output when the type of work changes or the installation subsequently is enlarged.

1000-amp, 6-v load, single shift

Load $\frac{1000 \text{ amp} \times 6 \text{ v}}{1000} = 6$ kw

kw (ac) req'd by rectifier at 55% efficiency $= \frac{6}{0.55} = 10.9$ kw

kw (ac) req'd by generator at 75% efficiency $= \frac{6}{0.75} = 8$ kw

Saving $= 2.9$ kw

2000 hr per yr and power at $0.02 per kwh

Annual saving $= 2.9 \times 2000 \times 0.02$
$= \$116$

10,000-amp, 9-v load, double shift

Load $\frac{10{,}000 \text{ amp} \times 9 \text{ v}}{1000} = 90$ kw

kw (ac) req'd by rectifier at 55% efficiency $= \frac{90}{0.55} = 163.5$ kw

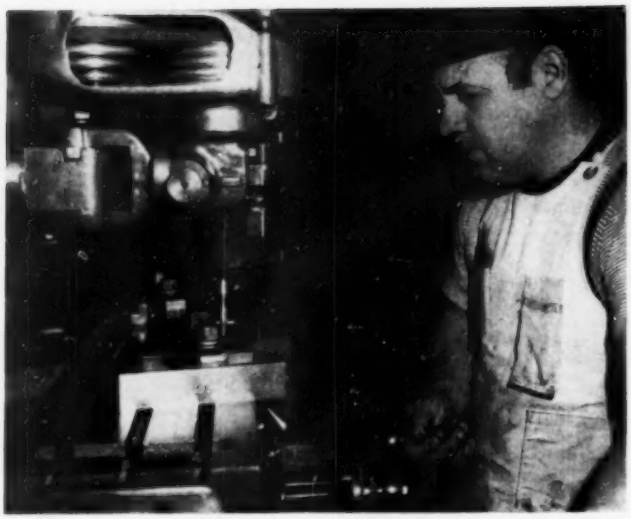
kw (ac) req'd by generator at 80% efficiency $= \frac{90}{0.80} = 112.5$ kw

Saving $= 51$kw

4000 hr per yr and power at $0.02 per kwh

Annual saving $= 51 \times 4000 \times 0.02$
$= \$4080$

Dies hardened to 62 Rockwell C are milled in routine operations at Parsons Tool, Incorporated. Drilling, boring, and counterboring are done with the same ease. By avoiding the time and expense of annealing or grinding, dies are quickly altered or repaired



Milling out a section from a die at 62 Rc to permit insertion of a "dutchman," or plug, modifying the design. Neither work nor tool heats, but chips come off cherry red

Hardened Steel Milled With Carbide

BY ANDERSON ASHBURN
ASSOCIATE EDITOR

MACHINING operations on dies hardened to 62 Rc have become routine at Parsons Tool, Inc., Berlin, Conn. Milling, drilling, boring, and counterboring are all done with carbide tools of company design.

Thus far this work has been largely confined to die repair. If a piece breaks off in a die or the design is changed to require die modification, usual practice is to anneal, machine, and reharden. Locating holes will have shrunk or shifted, the die may not fit the punch, and considerable grinding may be required.

If the die is repaired in the hardened condition, these problems are avoided. The section to be changed can be milled out to fit a "dutchman"—a hardened plug of the new shape—which is pressed into the die and further held by a capscrew from the bottom of the die.

MILLING

End mills have two or three teeth. Carbide tips are mounted with a heavy cushion of silver solder. A flat piece of silver solder is placed under the carbide, then brazing rod is applied. It is important to get thorough penetration in brazing to get all air out from under the tip.

Cutters have slight back taper to avoid drag which would heat the tool. Teeth have no rake on the 0.250-in. size, but on larger sizes they have negative rake ranging up to 5° on the 1-in. size.

Cutting-edge relief is 0.005 in. in 1/16 in. from the cutting edge, followed by a 14° clearance angle. The two-lip end mill is for roughing to get a hole big enough to bore. The three-lip end mill is for finishing operations.

In a typical operation, a ⅜-in. cutter is run at 2100 rpm, which is a surface speed of 210 fpm. Feed ranges from 0.015 to 0.030 ipr.

In a test, a slot about an inch deep was milled within a few thousandths of the side of the die. At this point the piece remaining broke off. Despite its thin section, it was not burned or annealed, indicating that virtually all of the heat is being removed in the chips.

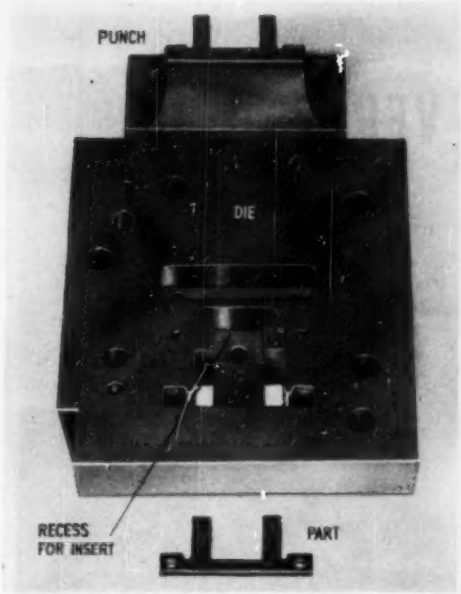
COUNTERBORES

Counterbores are similar in design to end mills, except that they have four teeth and a pilot. Each lip is ground with a flat on the end and 14° clearance. Tips are mounted to provide a slight hook (the outside edge cutting about 0.015 in. ahead of the center).

Back taper on counterbores is 0.005 in. per in. of length.

BORING TOOLS

The boring tools are very simple in design. Essentially they are simply a piece of carbide brazed across the end of a shank. The shank is turned down from a larger piece of steel so that there is support for the carbide.



Die and punch for hinge part had to be modified to increase width of central tongue by 0.010 in. Die is air-hardening Olympic Chromovan. Section has been milled out of the die and hole drilled and counterbored for capscrew to hold the insert in place

Three inserts had to be made on this die of Keystone oil-hardening steel. The center insert was required because one of the lips broke off in shearing in the punch. The other two were caused by design change. For the latter, the punch was ground off on the outside. Increased clearance was left on the inside of the punch because stock was thick enough to permit it

These cutters are mounted in swivel holders on a jig borer, so that there is no point in developing precise tool angles. They are ground with a round nose.

As the carbide wears, the brazing compound can be melted and the tip slipped outward, then brazed again. In this way it is possible to use nearly all of the carbide.

In jig boring hardened steel it is important to watch the chip disposal. The chips are hard and will score the machined bed surface.

DRILLS

Drills for holes from 0.050 to 3/16 in. are made from a piece of unsupported carbide brazed into a slot in the shank. For larger drills some support is provided, but it is not extended to the tip.

The theory is that if carbide is properly treated it does not require the careful support often given it, and if it is not properly treated all the support in the world won't keep it from breaking. As far as they are concerned, this theory is working out fine.

APPLICATION

Here is an example of what can be saved as a result of the ability to machine hardened steel. A large die used in the production of cover plates for sandwich toasters cracked during the Christmas rush last year. Several days' production, at the very best, would be lost before a new die could be made.

The cracked die was repaired by milling a slot across the crack to a depth of ⅞ in. A key was machined to fit this slot. Two dowel holes were drilled through the key and in matching position in the die, under the slot. A second pair of holes was drilled in both parts, counterbored on the underside of the die and tapped in the key.

When the key was driven into place over the dowels and held by screws from the die, the die was ready to run. Total time lost making the repair was only six hours.

In general, water-hardening steel has given more trouble than either oil- or air-hardening, because of its hard case and soft core.

Although most of the work at Parsons has been repair, these methods have found some application in new work. One instance is a dial plate to hold 20 small circular dies. After preliminary operation, the plate was hardened and each hole jig-bored to finished size. This was a much cheaper and faster way to produce the dial plate than grinding.

Other materials that have been machined with these tools include Nihard, Stellite and mild steel with a deposit of No. 1 Stellite in which the end mill was half in the mild steel and half in the Stellite.

Applications at Parsons have naturally been determined by the type of work encountered. It seems likely that with tools and methods such as these, many other problems with hard steel could be solved.

DIVIDING HEADS INCREASE TOOLROOM VERSATILITY

Inspection and diversified machining operations are facilitated by use of the universal dividing head. The work can be positioned accurately and indexed through known angular settings

BY MARIO MARTELLOTTI, CINCINNATI MILLING MACHINE CO.

To Check Parallelism and Alignment

MANY inspection operations can be carried out conveniently on parts mounted on a dividing head. Contour of cams, the spacing of holes, machined surfaces, gear teeth, and notches are excellent examples of milling operations that can be checked. Parallelism and alignment are frequent problems. As an example of the last usage, consider the method for checking keyways in a dolly for holding an impeller, Fig. 1.

To check the keyways for parallelism and alignment within 0.0002 in., the dolly is placed between centers of a dividing head and tailstock, and gage blocks are inserted in the keyways.

Set the 1.250-in. keyway parallel to the inspection table by manually rotating the dolly until a dial indicator reads constant as the indicator stem is moved radially on the gage block.

Now clamp the dolly to the dividing-head spindle with a driving dog, and index 180° to bring the second keyway into position. Make up for the width difference of the two keyways by laying a $\frac{1}{8}$-in.-thick gage block on top of the 1.000-in. block inserted in the second keyway. If radial movement does not change the indicator reading, the second keyway is parallel to the first one. Any deviation, taken at a point on the gage block corresponding to the 7-in. dia, indicates the amount by which the two keyways are out of parallelism. This deviation should not exceed 0.0002 in.

The variation in alignment is obtained from the difference between indicator readings at corresponding points on the two keyways. The same setup can be employed for checking the concentricity of the locating stud with the bored hole, and also the squareness of the various surfaces of the dolly.

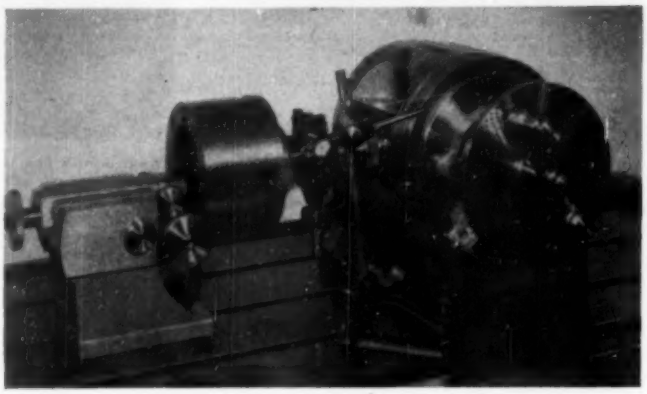


Fig. 1 .. Because of the accuracy and convenience of indexing work with a universal dividing head, the parallelism and alignment of two keyways of unequal width are readily checked to tenths

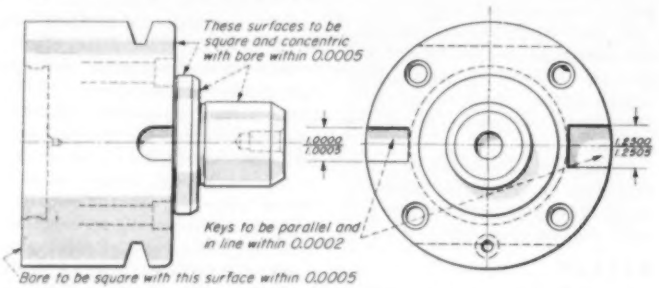

These surfaces to be square and concentric with bore within 0.0005
1.0000
1.0003
1.2500
1.2503
Keys to be parallel and in line within 0.0002
Bore to be square with this surface within 0.0005

Fig. 2 .. In addition to keyway location, the squareness of various surfaces on the dolly can be checked while it is mounted between centers of a tailstock and the universal dividing head

Abstracted from "A Treatise on Milling and Milling Machines," to be published at an early date

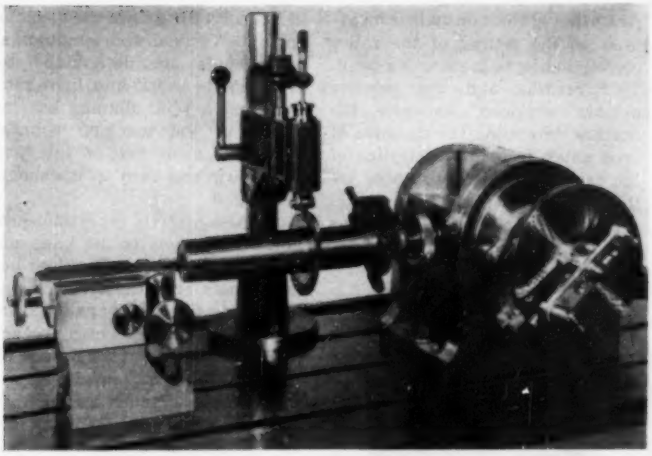


Fig. 3 .. Equipment required for checking a cam profile consists of a dividing head and tailstock so that the work on an arbor can be placed between centers and the rise increments checked with a cam-measuring fixture

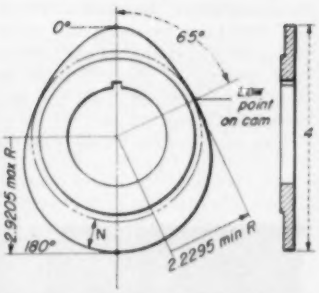


Fig. 4 .. Important elements of a cam profile can be checked with a dividing head, by indexing to the proper angular settings and comparing the rise with tabulated values on a drawing

Cam Inspection

TO CHECK the accuracy of a cam profile, Fig. 4, the dividing head is used in conjunction with a cam-measuring fixture. The latter consists of a plunger, carrying a roller of the required diameter and engaging the cam surface, and a micrometer for measuring the displacement of the plunger in relation to the angular displacement of the cam. Setup is shown in Fig. 3.

The dimensions of the cam are given in Fig. 4. Variations *N*, of the cam profile over the base circle of 2.2295-in. radius are listed in a separate table for every half degree of cam surface. Indexing for each half degree is obtained by moving the index pin three spaces on the 54-hole circle, starting at the low point on the cam surface.

The axis of the keyway is in line with the high points of the cam. One of the low points on the cam is accurately located by setting the keyway axis in a vertical position and then indexing 65°. This will locate the low point under the cam roller. The micrometer is set to zero reading at this point, and is then withdrawn before indexing.

To take the readings *N*, the micrometer stem is lowered to contact the plunger carrying the roller. These readings are checked against the values listed in the table of the original drawing.

Checking Notches on a Cam

THE SAME equipment can be applied to checking the location of four equally spaced notches in a cam, Fig. 5.

The cam is set in position for checking by locating one side of the 120° V-notch, corresponding to the starting point of the cam, in a horizontal position, or parallel to the inspection table. A dial indicator supported on a stand is utilized for this purpose.

When the indicator reads zero as it is moved in and out on the surface of the notch, the indicated surface will be parallel to the table. The centerline of the V-notch will be inclined at a 60° angle, or half the included angle of the notch, with respect to a horizontal line, and at a 30° angle with respect to the vertical. The centerline of this V-notch is placed vertically by indexing 30°. In turn, the other three notches can be placed under the

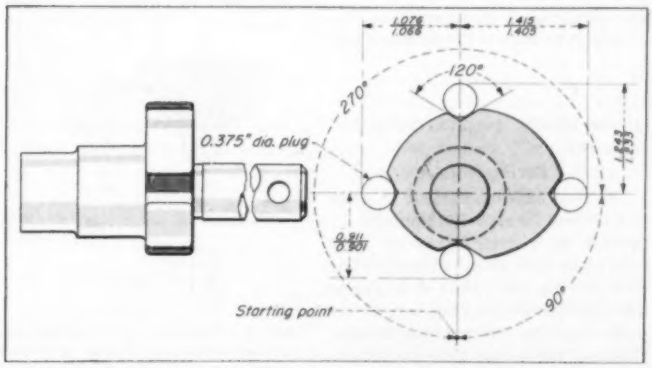


Fig. 5 .. Location of four equally spaced notches in a cam profile and correctness of the notch angle are established with a universal dividing head and dial indicator

roller of the fixture by indexing 90°.

Diameter of the roller of the measuring fixture is $\frac{3}{8}$ in., the same as the diameter of the plug shown in Fig. 5. Hence, the relative heights between the various notches are measured by using the roller of the fixture to engage each notch. The reading of the difference in heights is obtained from the micrometer in the fixture.

The height of the roller from the centerline of the camshaft is measured on the setting of the roller corresponding to the starting point. This reading and the relative heights obtained between the notches determine the distance of each notch from the centerline of the camshaft. These distances are then checked against the values given in the drawing. Gage blocks and a dial indicator are used for this measurement.

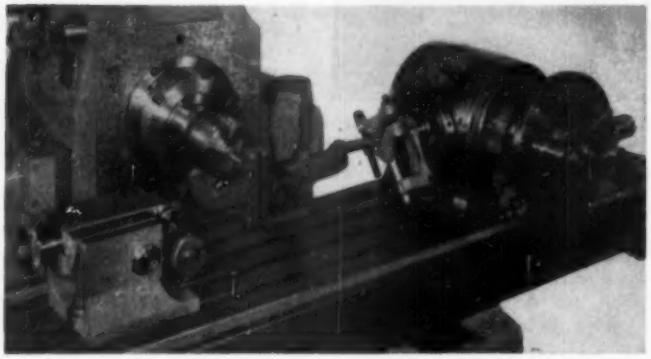


Fig. 6 .. Setup used for boring two holes at right angles in a pivot arm. The work is not yet in position to bore hole *A*

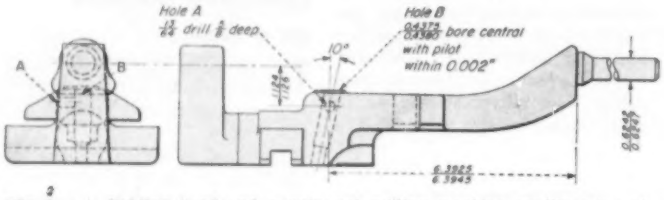


Fig. 7 .. A dividing head and a universal milling machine readily solve the problem of boring holes *A* and *B*, the latter being at an angle to the pivot-arm axis

Boring Holes at Right Angles

THE direct-indexing feature of the universal dividing head is often utilized as a means of positioning a workpiece. An example is the boring of two holes at right angles to each other on a pivot arm, Fig. 7.

The universal dividing head and tailstock are aligned along the center T-slot of the table of a universal knee-type milling machine, Fig. 6. A quick-change adapter on the machine spindle permits quick tool changes.

Boring Hole A

To bore hole *A*, surface *C*, (Fig. 8) is first located horizontally by means of a dial indicator. Next the pivot-arm stem is tightened on the driving dog. Hole *A* is placed in a horizontal position, but on the side opposite the machine spindle. Hence, the pivot arm is rotated 180° from this position by direct indexing.

Axis of hole *A* must now be set in line with the axis of the machine spindle. Vertical and longitudinal adjustments are determined by bringing the work into light contact with a 1-in. aligning bar inserted in the machine spindle. Contact is made first on the stem of the arm and then on the shoulder, Fig. 9.

As these contacts are established, micrometer dials of the knee and table are set to zero. Backlash between nuts and leadscrews of the knee and table is always taken up in the direction in which the adjustment is made. This is done by reversing the movement of the slide a distance much greater than the backlash, before making the adjustment. If, in making the adjustment, the slide movement exceeds the desired micrometer reading of the adjustment, the slide must be backed up and the foregoing procedure repeated until the correct setting is obtained.

The saddle is now moved out to clear the aligning bar, which is replaced with a centering drill. From Figs. 7 and 9, the longitudinal and vertical adjustments of the workpiece should be made within:

Longitudinal adjustment—

$6.3925 + 1.000 + 0.500 = 7.8925$ in.
$6.3945 + 1.000 + 0.500 = 7.8945$ in.

Vertical adjustment—

$$1.126 + \frac{0.6247 + 1.000}{2} = 1.9383 \text{ in.}$$

$$1.124 + \frac{0.6247 + 1.000}{2} = 1.9363 \text{ in.}$$

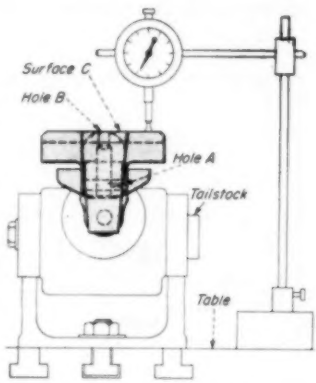


Fig. 8 .. Preliminary to boring hole *A*, the surface *C* of the pivot arm is set parallel to the machine table. Then the work is indexed 180° to bring the proper work face into position to bore the hole *A*

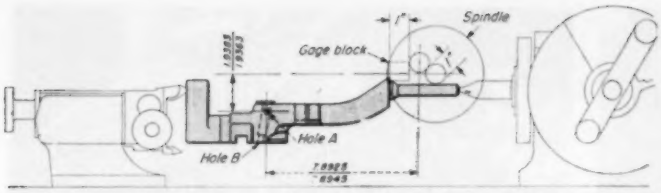


Fig. 9.. Coordinates of hole *A* are established by using a 1-in. gage block and a 1-in. aligning bar in the spindle, then moving the knee and saddle to bring the spindle centerline into position

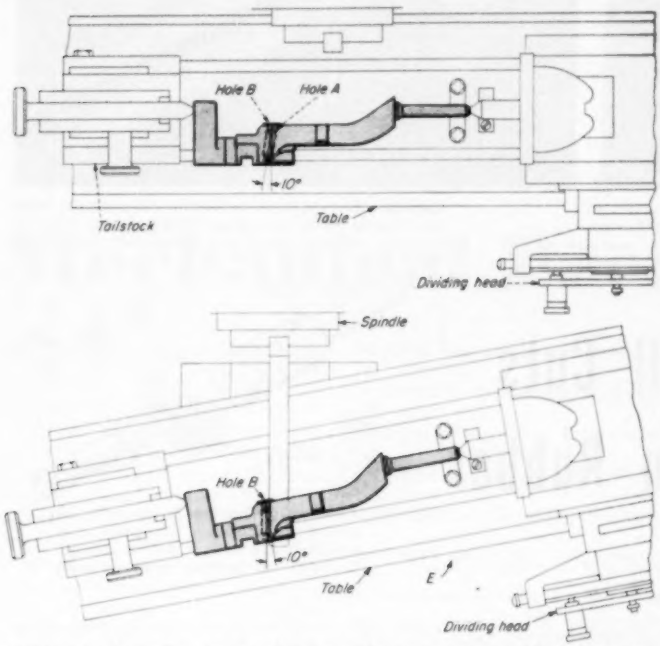


Fig. 10.. In the upper view, the pivot arm has been indexed 90° to bring the work into position for drilling and boring hole *B* at right angles to hole *A*. Then, as in the lower view, the table is swivelled 10° to bring axis of hole *B* into alignment for boring

When these adjustments have been completed, the center of hole *A* will be in line with the axis of the machine spindle. After spotting the hole with a center drill, the hole is drilled with a 13/64-in. drill to a depth of ⅝ in. by feeding the saddle.

Boring Hole B

For boring hole *B*, the pivot arm is rotated 90° counterclockwise from the previous position by direct indexing. This places the axis of hole *B* in a plane parallel to the surface of the machine table, as shown in the upper view, Fig. 10.

The milling-machine table is then swiveled 10° in the direction of arrow *E* lower view, Fig. 10, to place the axis of hole *B* parallel to the machine-spindle axis.

To place the axis of hole *B* in the same plane as the machine-spindle axis, the knee is raised between 1.124 in. and 1.126 in. from the position it occupied when boring hole *A*.

Longitudinal adjustment necessary to align hole *B* with the spindle axis is now obtained by inserting a 13/64-in. plug in hole *A* and a 1-in. aligning bar in the machine spindle. When the plug in hole *A* is in light contact with the aligning bar, the required adjustment will be:

$$\frac{1.000 + 13/64}{2} = 0.6015 \text{ in.}$$

After these adjustments have been made, a ⅜-in. end mill is used to spot a small surface to avoid side deflection of the drillpoint on a slanting surface.

The end mill is then replaced with a center drill. In turn, this is replaced with a ⅜-in. drill to drill a through hole. This is followed with a 13/32-in. drill to a depth of 1 19/32 in. The final operation is performed with a boring tool to finish the hole to between limits of 0.4375 in. and 0.4380 in. The various required positions of work could also have been obtained by plain indexing.

Another installment on non-milling jobs performed on the milling machine will be published in the June 26 number.

Not "Too Well Done"

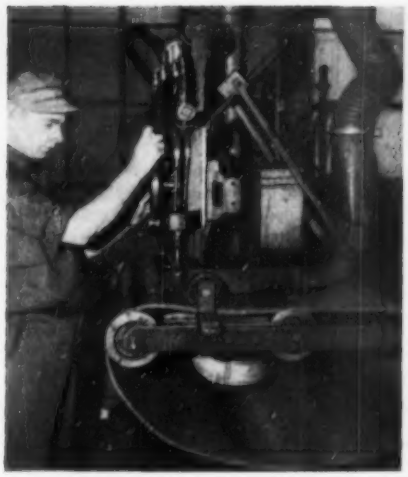
I was very much interested in John R. Godfrey's "Too Well Done Costs Too Much," in the *American Machinist*, May 15.

It reminded me of a job we did, building a piece of experimental machinery. A small internal gear had to be made to special dimensions as cheaply as possible. We made a single broach to keep cost to the minimum. This broach was made to take out about three times as much stock with each tooth as was considered best practice, and had only two finish-size teeth.

When used, two of the teeth chipped very slightly on the initial pass. We rotated the gear a half turn, bringing the damaged teeth to points where the teeth were correct from the first pass, then on the second pass the imperfect teeth were properly finished, thus making the gear satisfactory for the required experiment.

We could not have made a first-class broach on this occasion for the price allotted for the job.

John Mark May
Watervliet, N. Y.

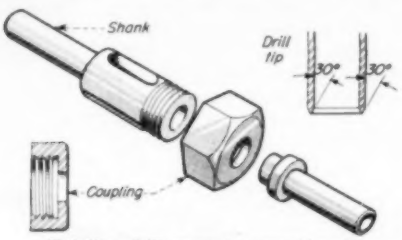


Up to 3000 holes are punched through rubber belts in regular patterns by revolving drill-punches on indexing carriage of shop-built machine

Carriage operates seven drills over roll-equipped table to cut holes on ½-in. centers. Index plate in front of operator controls travel and handwheel feeds drills

Shop-Built Drill Cuts Clean Holes in Rubber

BY M. E. FRAZEE, AMERICAN WHEELABRATOR & EQUIPMENT CORP.



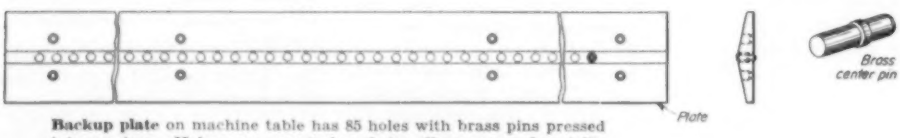
Rotating drill-punch is assembly of hollow, smooth-edge cutter, threaded coupling, and hollow, slotted spindle. Cutter is tapered down to edge

RUBBER is a difficult material to drill economically and quickly. Conventional drilling produces a flash on the edges of the holes, which catches abrasive, dust, and scale when the holes are in belts in airless abrasive blast cleaners. Holes can be burned to remove the flash, but the process is lengthy and expensive.

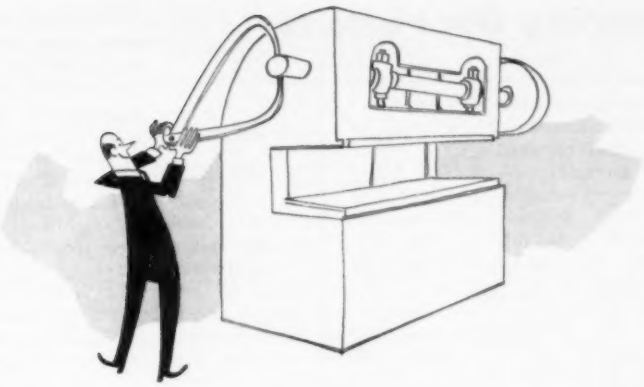
With a special machine built to produce holes in 8- to 13-ft belts, 24 in. to 40 in. wide and 9/16 in. thick, two operators can turn out belts for Wheelabrator cleaning equipment at a saving per belt of $35 on a $45 original cost by old methods. Drills on a moving carriage have smooth edges and hollow shanks. While one operator works the belt-feeding mechanism, the other pilots the drills to cut seven holes at a time.

A backup plate on the machine table holds press-fitted brass pins which push up the rubber slugs as they are cut by the high-speed drills. Suction from a ventilating system removes the plugs as they are forced up the hollow spindles and out of slots in the sides of the shanks. Drills are made in a number of sizes, to the same design, and there are different backup plates with different pin spacings for each size.

With this method, two men can cut 3000 holes in one belt in two hours, which beats former subcontracting time of six months. In addition, any hole size and spacing can be handled with the indexing carriage, whereas only a few patterns could be produced before the machine was developed.



Backup plate on machine table has 85 holes with brass pins pressed into centers. Holes are counterbored to allow space for drills



How to Select a Mechanical Press

BY SERGIUS D. BROOTZKOOS*

PROPER selection of a mechanical press presumes a knowledge of press construction, production methods for stampings, die designing and strength of materials. Experience and common sense are important.

Rated press capacity and actual work-pressure requirements are often quite different. The author shows how work pressures can be figured for presswork operations in four major groups, and gives accepted rules and formulas for figuring a suitable press size. He contributes an original chart, which gives the relationship between midstroke capacity and bottom stroke, or rated capacity, for presses in common use.

THE first pitfall in press selection is to consider only rated pressure capacity in relation to the pressure required for performing the work. Do not overlook the *work capacity* of the press. The following explains the distinction:

Rated pressure capacity is the tons pressure exerted by the slide near the bottom of the stroke. To avoid straining or breaking the press, the torsional moment (the torque) of this force in crankshaft-type presses must be within the torsional strength of the shaft.

Work capacity is the slide pressure multiplied by the "working" stroke and it is expressed in inch-tons. In mechanical power presses, the work done by the slide is obtained from expenditure of flywheel energy: 7 to 10% for flywheel presses and 10 to 20% for geared presses. With geared presses, the flywheel is allowed to slow down more because the driving motor has more time for regaining flywheel speed.

The work capacity of a mechanical power press thus may be considered a function of the stroke. The longer the working stroke, the lower the pressure that can be exerted at its starting point without excessive flywheel slowdown or stalling. This explains why a press with rated pressure capacity suitable for short-stroke operations like blanking, which occur near the bottom of the stroke may be unsuitable for a continuous pull over long part of the slide movement as in drawing or ironing. Therefore, it is logical to break down press operations into four groups, by work-pressure requirements: (1) shearing, (2) drawing, (3) bending and (4) squeezing.

* Author of "How Modern Mechanical Presses Operate" (*AM*—Nov. 17, 1949; p 101).

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Shearing Operations

UNDER "shearing operations," we can list these short-stroke operations: shearing proper, parting, blanking, punching, piercing, perforating, notching, trimming, and cutting off. The pressure requirements for any of these operations depend on the area to be severed and shear strength of the material:

$P_s = L\,t\,S$ and $P_s = \pi D\,t\,S$

where:

P_s = shearing resistance, tons;
L = length of cut, in.
t = thickness of material, in.
S = shear strength of material, tons per sq. in.
D = sum of diameters of round openings, in.

These formulas give maximum pressure requirements. Shearing tests show, however, that the shear blade or punch must penetrate the material only 45 to 70% to effect severance. The higher figure is for soft metals. In addition, accepted practice calls for grinding "shear" on shear blades, dies and punches with cutting edges. This practice further reduces pressure requirements by distributing the work over a longer part of the working stroke of the shear blade or punch. Where several punches are involved, they are usually made of different heights to stagger the work.

Against these factors tending to reduce pressure requirements, there are others which act to increase tonnage needs; namely dullness of cutting edges; stripping friction between punch and material; uneven clearance between die and punch due to a poor design and workmanship, or to careless die setting; uneven heating of dies during operation. Furthermore, some press engineers and users allow extra pressure capacity with a view of reducing rebound in the press frames at the breakthrough point.

To balance these factors, accepted practice for shearing work is to select a press with a rated capacity:

$P_p = 2/3\ P_s$ for stock from up to $\frac{1}{4}$ in.
$P_p = \frac{3}{4}\ P_s$ for stock from $\frac{1}{4}$ to 1 in.

where:

P_p = rated pressure capacity of press, tons
P_s = total shearing resistance of material, tons

Because shearing work is done near the bottom of the slide stroke, flywheel-drive presses are generally used for operations on thin stock, while single-geared presses are preferred for heavy material.

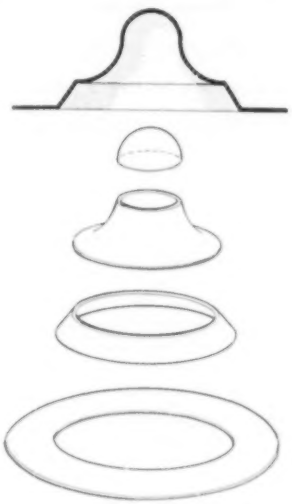
The slide stroke should be short —1 to 4 in. depending on metal thickness—to reduce impact effect of the punch. Also the stroke should be convenient for feeding and guiding the stock, removing blanks or scrap, and for inspection of die action. The die space (distance bed to slide, stroke down, adjustment up) should be sufficient for the available die or dieset.

Bottom face of the slide should have area sufficient to support the punch or punch holder and space all around for their fastenings. Bed size is determined by face area of the slide, but size of the bed opening must be large enough for blanks or slugs to fall through.

Drawing Operations

DRAWING WORK consists of forming articles in seamless cylindrical cone, drum, bell or crown shapes from flat sheet stock. Some of these can be drawn in one operation; others require two or more steps. The first operation is usually called the "drawing" operation, while the subsequent ones are called the "redrawing" or the "reducing" operations.

Most drawn articles are made from thin stock, and wall thickness does not change appreciably. If wall thickness must be thinned, as in the cartridge-case manufacture, the reducing operations are called "ironing." If an ironing operation is required to produce only a hard and highly polished surface on the shell walls, the operation is called "burnishing."



Exploded view of a seamless drawn article helps to resolve it into simple component shapes, so that the surface areas may be calculated and totaled to find the blank diameter

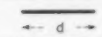
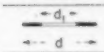
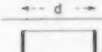
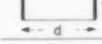
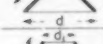
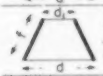
In drawing thin stock the blank must be held fast to the die face to prevent formation of wrinkles in the rim while the punch forces the blank inside the die. Therefore, the work is mostly done in double-action presses. These have two slides: an outer, or blankholding, slide and an inner, or drawing slide. Two types of double-action presses are: in use for shallow articles—cam drawing presses in which the blankholding slide is actuated by two cams mounted on the crankshaft; for deep and large articles—toggle drawing presses in which the blankholder slide is actuated by a toggle-link mechanism.

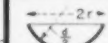
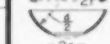
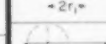
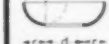
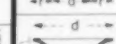
Single-action presses equipped with rubber, spring and especially with air or hydro-pneumatic cushions for supporting the blankholding ring in the die, are used extensively for seamless drawing work.

For reducing or redrawing work, double- and single-action presses are used, depending upon size and shape of the article. For ironing work, single-action presses are used exclusively.

In drawing articles from thick stock where the blank has enough body to resist formation of wrin-

SURFACE AREAS OF BASIC CIRCULAR SHAPES

Circular shape	Area—A	Blank diameter $D=\sqrt{\frac{A}{\pi/4}}$
	$A=\frac{\pi}{4}d^2$ DISK	$D=d$
	$A=\frac{\pi}{4}(d^2-d_1^2)$ RING	$D=\sqrt{d^2-d_1^2}$
	$A=\pi dh$ CYLINDER	$D=2\sqrt{dh}$
	$A=\frac{\pi}{4}d\sqrt{d^2+4h^2}=\frac{\pi}{2}df$ CONE	$D=\sqrt{d\sqrt{d^2+4h^2}}=\sqrt{2df}$
	$A=\frac{\pi}{4}(d+d_1)\sqrt{(d-d_1)^2+4h^2}$ $=\frac{\pi}{2}f(d+d_1)$ FRUSTUM	$D=\sqrt{(d+d_1)\sqrt{(d-d_1)^2+4h^2}}$ $=\sqrt{2f(d+d_1)}$
	$A=\pi d^2$ SPHERE	$D=2d$
	$A=\frac{\pi}{2}d^2$ HALF-SPHERE	$D=d\sqrt{2}$

Circular shape	Area—A	Blank diameter $D=\sqrt{\frac{A}{\pi/4}}$
	$A=\pi dh=\pi(r^2+h^2)$ SPHERICAL SEGMENT	$D=2\sqrt{dh}=2\sqrt{r^2+h^2}$
	$A=\pi dh$ $=\pi\sqrt{4r^2h^2+(r^2-r_1^2-h^2)^2}$ SPHERICAL ZONE	$D=2\sqrt{dh}$ $=2\sqrt[4]{4r^2h^2+(r^2-r_1^2-h^2)^2}$
	$A=\frac{\pi}{2}(\pi dr+4r^2)$ CONCAVE RING (QUARTER)	$D=\sqrt{2\pi dr+8r^2}$
	$A=\frac{\pi}{2}(\pi rd-4r^2)$ CONVEX RING (QUARTER)	$D=\sqrt{2\pi rd-8r^2}$
	$A=\pi[(d-2r)f+2rh]$ CONCAVE RING	$D=2\sqrt{(d-2r)f+2rh}$
	$A=\pi[(d+2r)f-2rh]$ CONVEX RING	$D=2\sqrt{(d+2r)f-2rh}$

kles, single-action presses are preferred over double-action presses. The general rule is to use single-action presses whenever:

$\frac{t}{D}\times 100 \gtrsim 2.4$ for ferrous metals

$\frac{t}{D}\times 100 \gtrsim 3.0$ for non-ferrous metals

where:

t = stock thickness, in.
D = blank diameter, in.
$\gtrsim$ = less than or equal to

Selection of a press for drawing work thus depends on:

1. Shape of the article.
2. Size of the blank.
3. The material and its thickness in the drawn article.
4. Shapes and heights of the shells during the drawing and redrawing operations.
5. Pressures required for performing drawing or redrawing work.
6. Type of press.

The shape of the finished article determines the blank size. In turn, the size of the blank, its material and thickness determine the number of drawing operations involved, their pressure requirements and types of presses to be used together with the sizes of their slide areas and strokes.

Blank Sizes

Blank size is calculated roughly, is later determined exactly during die tryouts.

Approximate blank size is found by measuring a sample article by a measuring tape; by stepping off its drawing with dividers, or by geometric calculations. These procedures are based on the assumption that the superficial area in the finished article is equal to that of the flat blank and that the thickness of the stock in the walls of drawn shells does not increase or decrease perceptibly.

Most seamless drawn articles are some shape of revolution and are drawn from round blanks. For area-calculation purposes the outline is divided into elementary sections—cylinders, cones, rings, spherical segments or zones, etc.—and the areas added to find the equivalent disk area, hence diameter.

For drawing a rectangular seamless article, the size of the sheet from which the blank can be cut is used for selecting a suitable press.

For irregularly shaped articles, approximate blank size is found as follows: The bottom is outlined, and the longest axis is then drawn. Through each point where there is a bend a bisector is drawn. Heights of walls at the straight stretches and corners are measured and marked around the outline. The line connecting these marks gives a rough outline of the blank.

Best procedure for finding the blank for a cylindrical article with a tapered wall thickness (ironed walls) is to weigh a sample. Then:

$$D = 1.13\sqrt{\frac{W}{ct}}$$

where:

D = blank diameter;
W = weight of article, lb (add 5% for trimming);
c = weight of metal, lb per cu in.
t = material thickness (at bottom), in.

If a sample is not available, cubic content of the metal is calculated from the drawing, and:

$$D = 1.13\sqrt{\frac{C}{t}}$$

where:

C = metal content, cu in., (add 5% for trimming).

Number of Draws

After finding the blank, decide the number of drawing operations. This depends on article shape, the kind, temper and thickness of material, and experience of die designer and the diemaker.

An accompanying table gives data for drawing straight-walled cylindrical shells with a small bottom radius from annealed stock up to 16 gage.

Notes:

Section *A* of that table gives average reductions for shell diameters in consecutive draws for

aluminum, brass and steel.

Section *B* shows the operation at which the highest ratio of the height to diameter in the finished shell can be achieved. For example, an aluminum shell of 2 in. in dia can be drawn 0.75 x 2 in. = 1.5 in. height in one operation; to 2.6 x 2 in. = 5.2 in. in two operations; and 4.5 x 2 in. = 9 in. in three operations.

Section *C* and *D* give the maximum diameters and heights of drawn shells at consecutive drawing and redrawing operations when expressed in terms of the shell blank. For example, a brass blank 15 in. in diameter can be drawn:

Operation	Diameter, in.	Height, in.
Drawing	15 x 0.52 = 7.8	15 x 0.35 = 5.25
1st Redraw	15 x 0.37 = 5.55	15 x 0.58 = 8.7
2nd Redraw	15 x 0.23 = 3.45	15 x 0.90 = 13.45

Rectangular seamless drawn shells are made in one or two operations, but seldom three because of the high cost of dies. The number of draws is controlled by corner radius where side walls of the shells come together. Ferrous-metal shells may be drawn in one operation up to 5 times, non-ferrous shells up to 7.5 times the corner radius.

It is impossible to give fixed rules for drawing shells of irregular shape.

In drawing shells with ironed side walls, the cup diameter usually equals that of the finished shell. In each ironing operation, thickness of the metal (brass or mild steel) can be reduced up to 55-60% if thoroughly annealed between operations. If equal reductions are used the number of ironing operations can be found:

$$n = \frac{\log S_o - \log S_f}{\log (1 + k)}$$

n = number of ironing operations
S_o = area of blank rim (thickness of blank times periphery)
S_f = final area of the rim.
k = reduction coefficient (normally 0.75)

Thus: $n = 4.1 (\log S_o - \log S_f)$

Drawing pressure

The drawing of seamless shells from a flat blank, cup, or shell involves pulling the metal through an annular opening between the punch and the draw edge of the die. The metal must be plastically deformed in the range above the yield point and below the ultimate tensile strength.

Namely: $\pi D\, t\, S_y \leq P_d \leq \pi D\, t\, S_u$

$$L\, t\, S_y \leq P_d \leq L\, t\, S_u$$

Where: $\leq$ = less than or equal to
P_d = drawing pressure, tons
D = dia of shell, in.
t = thickness of material, in.
S_u = ultimate tensile strength, tons per sq in
S_y = yield strength, tons per sq in.
L = length of draw edge in dies for non-circular shells, in.

When the drawing or redrawing work is done in a single-action press, resistance of the die cushion must be added to P_d.

Blankholding and stripping pressures in these die cushions vary with thickness and kind of metal and with size of blank or shell. Average figures are: to 150 psi for aluminum; 275 psi for brass, and 400 psi for mild steel. Thus, resistance of the die cushion is:

$$P_c = \left(\frac{\pi d_1^2}{4} - \frac{\pi d_2^2}{4}\right)\frac{P}{2000} = 0.0004P\ (d_1^2 - d_2^2)$$

where:
P_c = resistance of die cushion, tons
d_1 = dia of blank or shell, in.
d_2 = dia of drawn or redrawn shell, in.
P = average blankholding pressure exerted, psi.

Double-Action Presses

To select a double-action press of the cam or toggle type, choose one with a suitable blankholder and drawing-slide areas, and suitable depth of draw and life-out. The last figure cannot be changed in any double-action press without major changes in the design and timing of the press slides. Finally, check crankshaft capacity of the press.

Drawing work starts after the drawing slide passes midstroke. Hence midstroke pressure capacity is of primary importance. It should be always higher than the required drawing pressure, based on yield point of the work material.

For single-action presses, die-cushion resistance must be included in the calculation of the required midstroke capacity of the machine. See previous formula.

Strokes of slides in double-action presses cannot be changed. Slide stroke of single-action presses must be 1 to 2 in. greater than the double height of the drawn or redrawn shell. Die space (shut height) should be about three times the height of the shell to be drawn or redrawn.

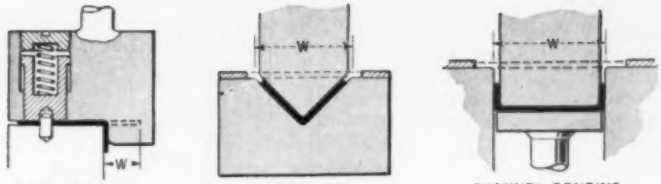
Selection of the press drive—whether flywheel, single or double geared—depends on permissible drawing speed of the metal used. This speed should not exceed 75 fpm for aluminum, 200 fpm for brass and 50 fpm for steel.

Since drawing of the metal commences just below midstroke, the crankpin speed is accepted as the speed of the drawing slide and

REDUCTIONS FOR CYLINDRICAL SHELLS

D = Blank dia; h = Height of shell; a = Aluminum; b = Brass and copper; s = Steel.

	Operation	Metal	First Drawing	Second 1st Redraw	Third 2nd Redraw
A	Reductions in drawing	a	$d_1 = 0.50\ D$	$d_2 = 0.65\ d_1$	$d_3 = 0.70\ d_2$
		b	$d_1 = 0.52\ D$	$d_2 = 0.70\ d_1$	$d_3 = 0.70\ d_2$
		s	$d_1 = 0.58\ D$	$d_2 = 0.80\ d_1$	$d_3 = 0.80\ d_2$
B	Max. h/D	a	0.75	2.6	4.5
		b	0.67	1.6	3.5
		s	0.50	0.9	1.6
C	Approx. dia in consecutive draws	a	0.50 D	0.33 D	0.23 D
		b	0.52 D	0.37 D	0.26 D
		s	0.58 D	0.46 D	0.37 D
D	Approx. heights in consecutive draws	b	0.38 D	0.87 D	1.03 D
		a	0.35 D	0.58 D	0.90 D
		s	0.29 D	0.42 D	0.58 D



EDGE BENDING V-BENDING CHANNEL BENDING

Be careful to use the correct formula for bending force

punch. Thus:

$$V = \frac{\pi s\, n}{12}$$

where: V = drawing slide speed at midstroke, fpm.
s = slide stroke, in.
n = strokes per min.

The number of strokes per minute determines the press drive. Usual figures are: about 100 spm for flywheel presses; about 30 spm for single-geared presses, and about 6 to 10 spm for triple-geared presses.

Bending Operations

BENDING is done in gap-frame or straight-sided, single-action presses with one or two cranks or suspension points. Gap-frame presses are preferred for bending long or wide strip stock. They are then built with narrow beds and slides and are called press brakes.

To bend any metal into desired shape it must be subjected to stresses in plastic range. It is assumed that compression stresses at the inside of the neutral plane of the bend and the tension stresses at the outside are equal to the ultimate tensile strengh of the metal. Hence, these formulas are used:

For edge bends:

$$P_b = \frac{lt^2}{2W} S_t$$

For free V-bends, with the load centrally located:

$$P_b = \frac{lt^2}{W} S_t$$

For channel and U-bends, with the load evenly distributed over the bottom of the bend:

$$P_b = \frac{2\ lt^2}{W} S_t$$

where:
P_b = bending force, tons
l = length of bend, in.
t = stock thickness, in.
W = width of unsupported metal, in.*
S_t = ultimate tensile strength of metal, tons per sq in.

For U-ing and channel bending, the presses are usually equipped with die cushions. The resistance of these must be added to pressure requirements found with the above formulas.

Since bending starts at some distance from the bottom of the slide stroke, the press must have a midstroke pressure capacity equal to or higher than indicated by the above formulas.

Note: For quick calculation and checking purposes, the following formula is sometimes used for finding bending pressure requirements:

$$P_b = 0.25\ lt\ S_t$$

* Width under the bending punch in edge bending, or width of opening in the V, channel or U-ing die, in inches.

Squeezing Operations

COLD squeezing work includes coining, embossing, hubbing, riveting, sizing, swaging, impact extruding, etc. In these operations, the metal must flow under pressure to fill out the die, or is compressed to exact thickness, or is forced out and extruded from the die in a tube-like shape. Work of this type is done at the bottom of the slide stroke, and is properly done on knuckle-joint and short-stroke eccentric presses.

The pressure requirements of squeezing work depends upon the metal, the character of the work, the area subject to pressure and, finally, on construction of the die for free or confined flow of metal. It can be expressed by the formula:

$$P_{sq} = a\ p$$

where:
P_{sq} = squeezing force, tons;
a = area under punch, in.
p = pressure, tons per sq in.

Since values of p vary for the same metal, depending on work to be done, the usual practice is to test the dies in a hydraulic press and to choose a mechanical press of double the pressure capacity indicated by the hydraulic press. This double factor has been adopted because of the comparative speed with which the two kinds of presses build up their working pressure.

If a hydraulic press is not available, the following general pressure figures may be used for choosing a mechanical press.

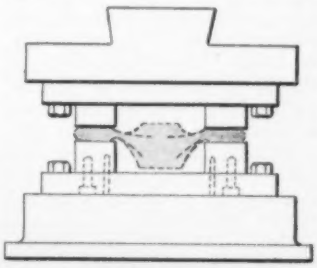
For general sizing, single-face embossing, swaging, and hubbing in open, free-flow dies—about 100 tons per sq in. for ferrous metals and 75 tons per sq in. for nonferrous metals.

The above figures should be increased 1½ to 2 times for sizing work with close limits, for double-face and intricate coining or embossing work, especially with thin stock, and for work with closed dies.

Cold riveting of wrought-iron rivets requires from 150 to 200 tons per sq in. of stem area. The higher figure is for rivets less than ½-in. dia.

Impact extrusion requires about 80 tons per sq in. for aluminum and 45 tons per sq in. for tin, zinc and lead-tin alloys.

Face areas of the press slide and bed are kept as small as possible



Squeezing operations, including sizing in an open, free-flow die, are best checked with a hydraulic press if available

to concentrate pressure and reduce spring in bed and frame. Single-geared presses are used as a rule.

Miscellaneous Operations

Selection of presses for less frequently used operations follows the rules given for the major groups discussed. For example, in beading or bulging, the metal is stretched. Hence, rules for drawing work may be used. For flanging work, the rules for edge bending apply.

Final Steps in Press Selection

AS THE final step in selecting a mechanical press, ascertain its rating after the work-pressure requirements are determined and a general decision is made on the type.

Rated capacity of a mechanical press is the pressure that the slide is expected to exert at the bottom (lower dead point) of the stroke.

For crankshaft presses, bottom capacities of the slide are determined by the diameter of crankshaft at the main bearings. See accompanying table.

In gear-eccentric presses and in all inclosed presses rated bottom capacities are usually indicated on the nameplates. If not so identified, tierod diameters may be used. See table below, right.

End-wheel presses are rated by the diameters of the overhanging pins.

Presses intended for work near the bottom of the slide stroke are selected according to their rated pressure capacities.

Slide Pressure Fluctuation

Presses starting their work at some distance above the bottom of their slide stroke are selected according to their midstroke pressure capacity. This is done because in mechanical power presses the slide pressure fluctuates during its working stroke. These fluctuations are due to variations in the angular position of the crankpin or the gear-eccentric at various distances of the slide from the bed, and upon the ratio of the slide stroke to the length of the oscillating press pitman or connection.*

These conditions can be expressed mathematically:

$$M_t = P\,\frac{s}{2}\,(\sin\alpha + \frac{k}{2}\,\sin 2\alpha)$$

where

M_t = torsional moment of crankshaft or eccentric created by slide pressure, in-tons.

P = slide pressure, tons

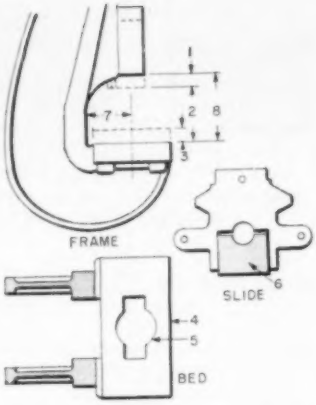
s = stroke of the slide, in.

α = angle determining the position of crankpin or gear-eccentric from lower dead point.

k = ratio of the stroke of the slide to length of pitman.

The above is the basic formula for determining the slide pressure in an ideal press (without frictional losses or bending stresses) at any position of the slide stroke.

Angular position of the crankpin or gear-eccentric at the midstroke of the slide is about 90° from the lower dead point. Assume that



Check die-space plan for actual working dimensions, after the press is selected. Points to watch are:

1. Stroke of slide (or slides in double-action presses).
2. Die space: Distance bed to slide, stroke down, adjustment up (shut height).
3. Bolster plate thickness.
4. Bed area.
5. Bed opening.
6. In gap-frame presses: area of slide or slides.
7. Gap: distance back from center of slide (stem hole).
8. Distance bed to gibs.
9. Width between frames.

RATED CAPACITIES, OR BOTTOM-SLIDE PRESSURE, OF CRANKSHAFT PRESSES

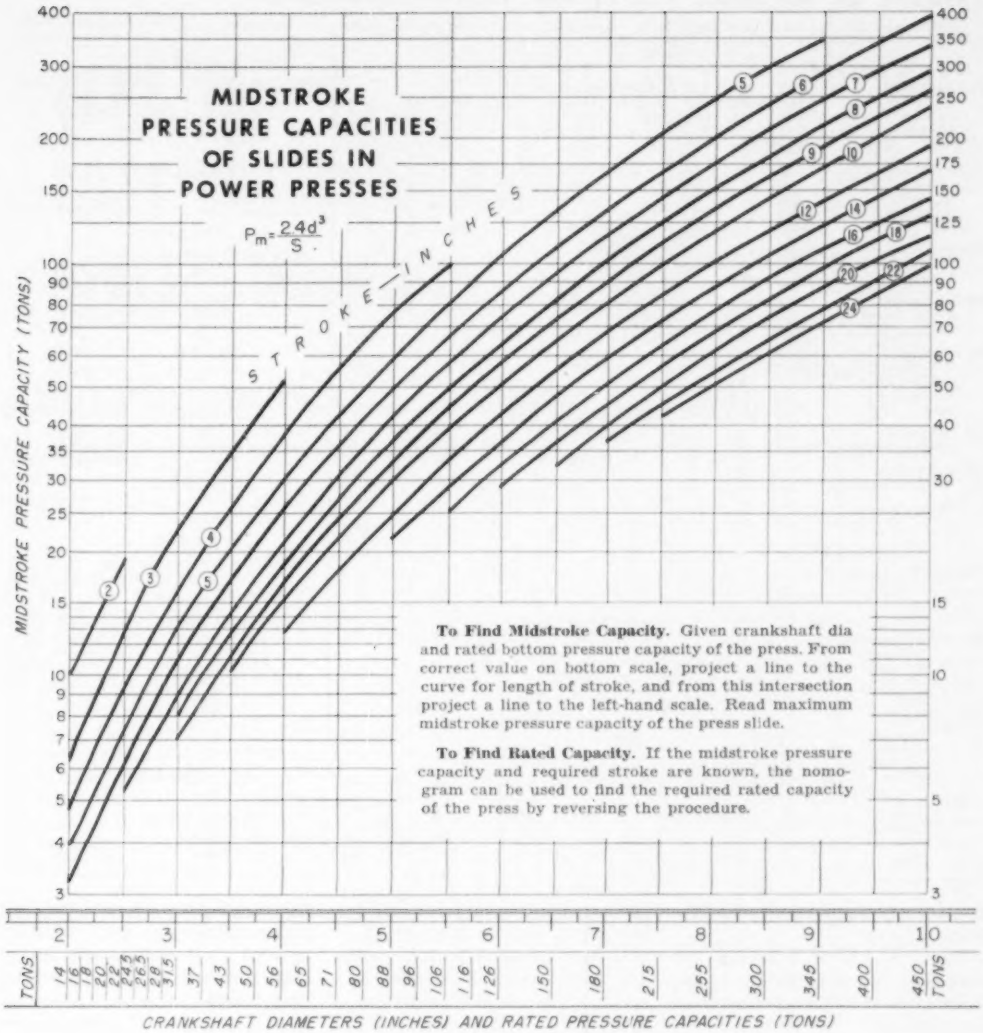
RATED CAPACITY	DIAMETER OF: CRANKSHAFT[1]	OVER-HANGING PIN[2]
TONS	INCHES	INCHES
3	1	1⅛
4	1⅛	—
4½	1¼	1½
6	1⅜	—
7½	1½	1¾
9	1⅝	—
10½	1¾	2
12	1⅞	—
14	2	2¼
16	2⅛	—
18	2¼	2½
20	2⅜	—
22	2½	2¾
24	2⅝	—
26½	2¾	3
28	2⅞	—
31½	3	—
37	3¼	3½

RATED CAPACITY	DIAMETER OF: CRANKSHAFT[1]	TIERODS[3]	OVER-HANGING PIN[2]
TONS	INCHES	INCHES	INCHES
43	3½	2	4
50	3¾	2	4½
56	4	2¼	—
65	4¼	2¼	—
71	4½	2½	5
80	4¾	2½	—
86	5	2¾	5½
106	5½	3	6
126	6	3¼	7
150	6½	3½	—
180	7	3¾	—
215	7½	4	—
255	8	4½	—
300	8½	4¾	—
345	9	5	—
400	9½	5½	—
450	10	5¾	—

[1] Diameter of crankshaft in single- or double-crank, open-frame presses
[2] Diameter of overhanging pin in end-wheel presses
[3] Diameter of tierods in one- or two-point suspension, closed-frame presses.

Pressure capacity figures are given for all single-action presses and for the inner, or drawing slide, of double-action presses. Crankshaft diameters are measured at main bearings. These capacities are based on standards adopted by the Committee on Metalworking Machinery of the Technical Committee on Standard Commodity Classification, Division of Statistical Standards, Bureau of the Budget, Washington.

* For a full theoretical analysis of this matter see author's book: "The Selection of Presses," Dryden Press Co., New York, pages 63 to 93.


MIDSTROKE PRESSURE CAPACITIES OF SLIDES IN POWER PRESSES
$P_m = \frac{24d^3}{S}$
STROKE—INCHES
MIDSTROKE PRESSURE CAPACITY (TONS)
To Find Midstroke Capacity. Given crankshaft dia and rated bottom pressure capacity of the press. From correct value on bottom scale, project a line to the curve for length of stroke, and from this intersection project a line to the left-hand scale. Read maximum midstroke pressure capacity of the press slide.
To Find Rated Capacity. If the midstroke pressure capacity and required stroke are known, the nomogram can be used to find the required rated capacity of the press by reversing the procedure.
TONS
CRANKSHAFT DIAMETERS (INCHES) AND RATED PRESSURE CAPACITIES (TONS)

it is at 90°. Then:

$$\text{Sin } \alpha = \sin 90° = 1$$
$$\text{Sin } 2\alpha = \sin 180° = 0$$
$$M_t = P\frac{s}{2}\left(\text{Sin}\,\alpha + \frac{k}{2}\text{Sin}\,2\alpha\right) = P\frac{s}{2}$$

Crankshaft presses are built on the basis of a selected torsional stress which their crankshafts must withstand under severe conditions of press work.

The torsional moment that a round shaft (crankshaft included) can withstand is:

$$M_{max} = \frac{\pi d^3 S_{sh}}{16} = 0.2\, d^3 S_{sh}$$

where:

M_{max} = torsional moment, in-tons
d = dia of shaft (at main bearings), in.
S_{sh} = selected shearing resistance of shaft material, tons per sq in.

Midstroke pressure capacity P_m of the press slide may then be expressed by the formula:

$$M_{max} = P_m \frac{S}{2}$$
$$P_m = \frac{2\,M_{max}}{S} = \frac{2 \times 0.2\, d^3}{S} S_{sh}$$
$$= \frac{0.4\, d^3}{S} S_{sh}$$

where S = stroke of the slide, in.

In most presses, crankshafts are forged from 0.35 – 0.45% carbon steel and heat treated. Accepted shearing strength is usually:

6 tons per sq in. in all single-driven presses with a flywheel or a main gear on one end of crankshaft.

9 tons per sq in. in twin-driven presses with main (bull) gears on each end of the crankshaft. This drive is used on presses with crankshafts over 7 in. in diameter with slide stroke longer than twice the diameter at main bearings. Same rule is applied, in addition,

STRENGTH OF MATERIALS PLATES AND STRIPS *(in tons per square inch)*

MATERIAL	YIELD	ULT.	SHEAR
ALUMINUM			
2S – O Annealed	2.5	6.5	4.7
1/4 Hard (H12)	6.5	7.5	5.0
1/2 Hard (H14)	7.0	8.5	5.5
3/4 Hard (H16)	8.5	10.0	6.0
Hard (H18)	10.5	12.0	6.5
3S – O Annealed	3.0	8.0	5.5
1/4 Hard (H12)	7.5	9.0	6.0
1/2 Hard (H14)	9.0	10.5	7.0
3/4 Hard (H16)	10.5	12.5	7.5
Hard (H18)	12.5	14.5	8.0
17S – O Annealed	5.0	13.0	9.0
T4 Heat Treated	20.0	31.0	19.0
T Alclad, H. Tr.	16.0	27.5	16.0
24S – O Annealed	5.5	12.5	9.0
T Heat Treated	23.0	34.0	20.5
T Alclad, H. Tr.	21.5	32.0	20.5
52S – O Annealed	7.0	14.5	9.0
1/4 Hard (H32)	13.0	17.0	10.0
1/2 Hard (H34)	14.5	18.5	10.5
3/4 Hard (H36)	17.0	19.5	11.5
Hard (H38)	18.0	20.5	12.0
53S – O Annealed	3.5	8.0	5.5
T4 Heat Treated	10.0	16.5	10.0
61S – O Annealed	4.0	9.0	6.2
T4 Heat Treated	10.5	17.5	6.7
75S – Alclad, Annealed	7.0	16.0	.....
T " H. Treated	33.0	38.0	23.0
BRASSES			
Gilding – 95% Annealed	7.0	19.0	15.0
1/4 Hard	16.0	21.0	16.0
1/2 Hard	20.0	24.0	17.0
Hard	25.0	28.0	18.5
Commercial Bronze, 90%			
Annealed	7.5	20.5	16.0
1/4 Hard	17.5	22.5	16.5
1/2 Hard	22.5	26.0	17.5
Hard	27.0	30.5	19.0
Red Brass, 85%			
Annealed	9.0	22.5	16.5
1/4 Hard	19.5	25.0	17.5
1/2 Hard	24.5	28.5	18.5
Hard	28.5	35.0	21.0
Low Brass, 80%			
Annealed	10.0	25.0	16.5
1/4 Hard	20.0	26.5	18.0
1/2 Hard	25.0	30.5	19.5
Hard	29.5	37.0	21.5

MATERIAL	YIELD	ULT.	SHEAR
(Brasses . . . continued)			
Cartridge Brass, 70%			
Annealed	11.0	26.5	17.5
1/4 Hard	20.0	27.0	18.0
1/2 Hard	26.0	31.0	20.0
Hard	31.5	38.0	22.0
Yellow Brass, 65%			
Annealed	11.0	26.5	.....
1/4 Hard	20.0	27.0	18.0
1/2 Hard	25.0	31.5	20.0
Hard	30.0	37.0	21.5
High Silicon, 'A', 3%			
Annealed	15.0	31.5	22.5
1/4 Hard	17.0	34.0	23.5
1/2 Hard	22.5	39.0	25.0
Hard	29.0	47.0	28.5
CARDBOARD			
Soft	.....	.....	2.0
Hard	.....	.....	4.0
COPPER			
Electrolytic, tough pitch			
Annealed	5.0	16.0	11.0
1/4 Hard	15.0	19.0	12.5
1/2 Hard	18.0	21.0	13.0
Hard	23.5	25.0	14.0
FIBER			
Vulcanized: Soft	.....	7.5	10.0
Hard	.....	.....	14.0
INCONEL			
Annealed, Hot rolled	22.5	47.5	32.5
As Rolled " "	30.0	60.0	37.0
Annealed, Cold rolled	18.5	45.0	31.5
Hard, " "	54.0	78.0	41.5
LEATHER			
Soft	.....	.....	4.3
Hard	.....	.....	7.1
LEAD			
Commercial pure	0.6	1.2	0.9
MAGNESIUM			
ASTM: #AZ31X Annealed	11.0	18.0	10.5
" Hard rolled	17.5	22.5	10.5
" #AZ61X Annealed	11.5	20.0	10.0
" Hard rolled	17.0	23.5	11.0
" #MI Annealed	8.0	16.0	9.5
Hard rolled	13.5	18.5	10.0

MATERIAL	YIELD	ULT.	SHEAR
MONEL			
SOFT, Cold-rolled	17.5	37.5	25.0
1/4 Hard	27.5	40.0	.....
1/2 Hard	.....	45.0	.....
3/4 Hard	.....	50.0	.....
Hard	50.0	55.0	32.5
MONEL "K"			
Annealed	30.0	60.0	37.5
Cold worked	60.0	80.0	50.0
NICKEL			
'A' & 'L' Annealed, hot rolled	10.0	31.5	26.0
" As hot rolled	24.0	42.5	.....
" Annealed, cold rolled	10.0	31.5	26.0
" As cold rolled	15.0	36.0	.....
'D' Hot rolled	17.0	43.0	.....
'Z' Hot rolled	17.0	45.0	.....
NICKEL-SILVER, 'A', 18%			
Annealed	15.0	30.0	28.5
1/4 Hard	25.0	32.5	.....
1/2 Hard	31.0	37.0	.....
Hard	37.0	42.5	39.0
PAPER			
Soft	.....	.....	2.0
Hard	.....	.....	2.5
STEEL			
Hot Rolled, #4 to #18 Ga.	15.0	26.0	20.0
" " #19 to #24 Ga.	15.0	25.0	20.0
Cold Rolled Strip			
Grade #1: Hard	.....	40.0	30.5
" #2: 1/2 Hard	.....	32.0	25.0
" #3: 1/4 Hard	16.0	27.0	21.5
" #4: Soft	.....	24.0	21.0
" #5: Dead Soft	.....	22.0	20.5
Stainless: #302,(18–8)	15.0	37.0	28.5
TIN			
Straits, Grade 1			
Annealed	0.65	1.1	1.5
Cold Rolled	1.0	1.4	1.5
ZINC			
Commercial, Rolled:			
Hot: Parall. to rolling	.....	9.7	8.5
" Across rolling	.....	11.5	8.5
Cold: Parall. to rolling	.....	10.5	9.5
" Across rolling	.....	13.5	9.5

to all wide, (right to left) double-crank presses.

Thus, simplified formulas for maximum permissible midstroke capacity of the slide of crankshaft presses are:

Single-driven presses:

$$P_m = \frac{2.4\ d^2}{S}$$

Twin-driven presses:

$$P_m = \frac{3.6\ d^2}{S}$$

The accompanying nomogram gives the relationship between midstroke pressure capacity, stroke and crankshaft diameter of presses with 2- to 10-in. crankshafts, with slides strokes from 2 to 24 in. and for rated (bottom) pressure capacities in the nomogram by 1.5.

For a twin-driven press multiply the figures for rated midstroke capacities in the nomogram by 1.5.

In gear-eccentric presses, calculation of the midstroke pressure capacity of the press slide presumes a knowledge of the maximum torsional moment on the gear-eccentric used in designing the press. This maximum torsional moment depends on the rated pressure capacity of the press, on the initial position of the press slide where the rated pressure must be exerted and the ratio k. Therefore, the midstroke pressure capacity of the slide in the gear-eccentric presses must be ascertained from maker.

However, since gear-eccentric presses are built in competition with crankshaft presses, it may be assumed that their midstroke pressure capacity is within the same limits as in crankshaft presses. This assumption is supported by the fact that the diameters of the fixed pins on which the gear-eccentrics revolve are usually made to the same diameter as the crankshafts in crankshaft presses of the same rated capacity. Therefore, the nomogram for midstroke capacities of crankshaft presses may be used also for finding the midstroke capacity of slides in gear-eccentric presses.

In conclusion, it must be stated that the selected presses should always be checked as to actual working dimensions by consulting a "die space" plan. The usual die space plan for an inclinable, open-back power press is shown. On this plan are marked the points in the construction of *any* selected press which should be checked either when the dies are available or a decision on their general shapes is to be made.

HERE IS COST-CUTTING THAT REALLY WORKS

Foremen and supervisors are the key men in a 3-step program that will help you tap the vast reservoir of cost-cutting knowledge that is available within your own organization

BY AUREN URIS and JOHN H. KOSTMAYER, RESEARCH INSTITUTE OF AMERICA

ALL cost-cutting procedures fall into two classes: those that really work, and those that don't. In both instances, management is solidly behind the plan. Yet one succeeds where the other fails. Why? Experience shows that it is largely a matter of method—that there are certain pitfalls that must be avoided, and certain steps that must be taken.

First of all, management must consider the background of the present business situation. During the war, it was a case of production-at-any-cost. Then came the postwar years and a period of easy profits. Money was plentiful and any reasonably good product could be sold for an unreasonable price. Thus, for a decade, there was widespread indifference to high production costs.

Suddenly the picture changed. Orders fell off. There was talk of layoffs, even of recession. The easy ways were no longer good enough. It was a matter of getting costs in line—or getting out of business.

Some Cut the Budget

To many companies, the new situation presented the need for immediate and drastic action. The easiest, and in many ways apparently the most logical, method of cutting costs was by across-the-board reductions in everything that contributed to high operating ratios.

The order went out from the front office: Slash everything! Cut payrolls, pare budgets, reduce expenditures by 5% — 10% — 15%. One organization reduced it to the ultimate fine point; it cut out the percentage of paper drinking cups by the same percentage that it cut personnel.

But, in company after company, the hopes for reductions in the final cost of the product did not materialize. In some cases, the attempted — and expected — economies actually resulted in *higher* costs. Apparently cutting budgets and cutting costs were not one and the same thing.

Failure to effect reductions brought a closer examination of the problem. Scores of examinations began to point toward ideas like the following: Many management people had lost the ability to do an effective cost-control job. Others, especially younger management personnel, had a business career confined to the war and postwar period, actually had no experience with the hard realities of business life under normal conditions. . . Lower echelons of management, supervisors and foremen, seemed to cooperate only half-heartedly; sometimes even went so far as to buck top management's cost-cutting plans.

"Slash everything! Cut . . . Pare . . ."

What Do Supervisors Think?

Part of the difficulty lies in the difference between the attitudes of top management and those of everyone else in the company. Executives, keenly aware of the situation, feel an urgent need for sudden and effective action. But supervisors and department heads, to say nothing of rank-and-file employees, have no such feeling.

Supervisors and foremen—key men in any cost-cutting campaign—reacted like this: Supervisor A: *"More economy talk. The company's been making money hand over fist for the last ten years."* Supervisor B: *"I cut my departmental expenses to the bone last week. Doesn't anybody in the front office know what's going on*

out here?" Supervisor C: *"This morning the boss told me my work would pick up, wanted me to put two more men on. Why don't they get together on what's going on around here?"*

But Costs Went Higher

In companies using that unsuccessful cost-cutting procedure, management thinking and action proceeded as follows: The president studied the cost-cutting problem carefully. His analysis was painstaking and thorough. In going over the books with the treasurer, he decided to reduce budgets 10% across the board. He felt that this would be fair to all and would not work an undue hardship upon any department or any group of employees.

The decision was put into effect. The company's outlay of money went down immediately. But at the end of the quarter, records showed that production had fallen off *more* than proportionately. Unit cost had actually risen.

What took place in two departments gives some picture of why the plan didn't work: One department that had been a production bottleneck for some time actually ought to have received an *increased* budget. It needed more personnel and new equipment to handle a new line more efficiently. In a second department, the cut was both *too little and too late*. Actually this department was so badly in need of streamlining that it could have stood — and profited by — a far larger cut than the 10% ordered. So it continued to be a prime cost leak after the cost-saving effort.

Successful Cost-Cutting

Contrast this failure with a method which, in company after company, has yielded cold-cash results: Top management did little more than decide to lower unit costs. The president's first step, instead of announcing a budget cut, was to turn the problem over to other levels of management for implementation. And this was carried right down to front-line supervisors. Instead of asking each department to bear an even share of the burden, each department head was asked how much he could reduce the cost of his operation.

"Make it clear that the situation can be met only by cutting costs . . ."

The cost-cutting program was developed in three major steps: (1) All members of management were asked to participate in the effort. (2) Top management supplied middle management with methods of enlisting the cooperation of foremen. (3) Every effort was made to draw rank-and-file employees into the campaign.

These steps are applicable in any organization and have a proved record of success in companies that vary widely both in type of operation and total number of personnel.

The First Step

The basic purpose of the first step is to sell all members of management on the need for cost cutting. On the face of it this would seem to be unnecessary. In a sense it is. Most members of management would declare themselves to be in favor of cost cutting if confronted directly with the question. But this doesn't mean being so thoroughly sold that there is positive compulsion to do something about it. The distinction is an important one.

Unless the concept is *sold*, unless people all the way down the line get a clear picture of the problem and a partial look at the solution, top management's attempts will be frustrated by the very people who should do most of the work of getting the job done.

This first step is best carried out through staff meetings or conferences. The number of meetings, and the size of the groups involved will depend upon the number of personnel in the organization, the scope of the cost-cutting effort, the geographical distribution of the individuals whose participation is desired.

As a general rule, and where the organization is large enough, such conferences should begin with the chief executive responsible for cost cutting at the operational level. For example, the president might hold the first conference with the members of his staff responsible for major divisions: the treasurer, sales manager, production manager, and so on. Each of these individuals, in turn, holds similar or related cost-cutting conferences with his staff, generally executives at the divisional level, such as superintendents. The superintendents are thus equipped to move down to the first and second levels, perhaps foremen and assistant foremen, with the discussions of the cost-cutting need and possible approaches to the development of solutions.

Sell the Need for Savings

Such staff meetings or conferences should be simple and streamlined. Each should open with a presentation of the company's competitive position and economic status. This should not be done by the individual who is to handle the actual discussion of cost-cutting methods that is to follow. It can usually be done best by a senior executive, possibly a financial man such as the treasurer or controller. The following ground should be covered: (1) existing demand for the company's product;

(2) market status of competitive products, including comparative prices and other competitive factors, such as quality; (3) the effect of economic pressures on sales and prices; (4) the role of high costs in the company.

Such a talk need not be any longer than the time required to make it clear that the situation can be met only by cutting costs—and doing it quickly. After the talk, time should be allowed for questions. If those present have unanswered questions, they will continue to think about them when the meeting has gone on to the discussion of cost-cutting methods. Obviously the questions must be answered as completely as the company's competitive position permits.

The Second Step

The purpose of the second step is to develop actual methods that can be applied by front-line management. Once supervisors are convinced that they should take cost-cutting steps, their first question is, "Where do I begin?"

When this question is asked, progress is right around the corner. But it won't come easily. Supervisory thinking must be properly channeled or it won't be effective in this area. And the best method of channeling—of actually tapping the vast reservoir of experience and know-how at the front-line of management—is by asking supervisors the questions that have to be answered if unit costs are to be reduced.

Experience shows that these questions should be built around the supervisors' familiarity with the five basic sources of waste: waste of effort, material, talent time, and money. The superintendent or supervisor who conducts his staff meeting on this basis will throw the spotlight squarely on troublesome cost leaks.

Questions Stimulate Thinking

Regarding conservation of effort, he might ask the following questions: Is any of the work in the department, no matter how important it once was, now unnecessary? The next question obviously asks for suggestions about what can be done to correct the situation. Is some of the work we're doing in our department being done elsewhere in duplication of our effort? If it is, the leader of the discussion might ask where it is done more efficiently, whether the operation should be consolidated, and so on.

The leader should conduct his entire series of discussions on the basis of such questions. Under each of the five headings, he should prepare a series of questions for use in guiding the discussion. He may not use these questions but it is well to have them on paper to fall back on. As the leader will find it useful to define the five major sources of waste, the following are suggested as guides.

Waste of effort: unnecessary handling of material for temporary storage in process.

Waste of material: spoiling an entire run by failing to check carefully the tolerances of the first few pieces.

Waste of talent: a machinist on a machine operator's job.

Waste of time: operators standing by because setup men are too busy.

Waste of money: purchase of improper supplies or equipment; larger quantities than are needed.

At this point the argument may arise that the same thing is a waste of talent and time; of effort and material. But the hotter this argument grows, the better, as it drives the point home. You then make the point that the wastes are actually inter-related, that in the final analysis they all amount to wastes of money. And preventing that waste is what you're after. Once your front-line people understand this approach to cost cutting, they can get down to brass tacks in their own departments.

The Third Step

It's obviously important to win the cooperation of rank-and-file employees. They're in a position to help if they go along with management, which to them is front-line supervision; they're in a position to nullify the effort if they *don't* go along. The only known way to get cooperation, especially in this kind of undertaking, is through participation. A mere passive following-out of orders from above is not even a neutral position. It may actually hinder the effort.

One Foreman Did This

This is the way one foreman went about it: He asked his people to get together for an informal chat. He told about the report that he had received as a member of the supervisory staff. He described the company's position. (If this story can be garbled, it is well to give the supervisors brief but exact information to pass on to the subordinates). He made it clear that he wasn't talking about lay-offs. But he also spelled out the fact that needless expenses had to go. He then asked for suggestions to reduce costs in the department.

By going through the questions under the five general headings which had grown out of his own management meeting, he encouraged his group to come up with a number of workable ideas. And equally important, he assured their willingness to accept the cost-cutting innovations that were developed at the staff meetings at top, middle, and front-line levels.

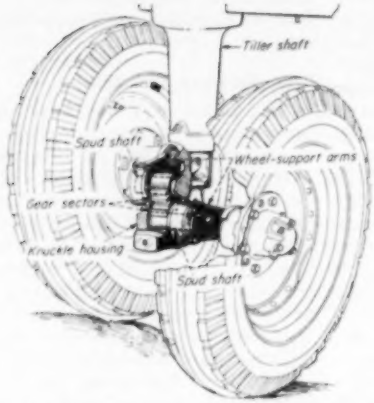
Tips FOR TOP SHOP MEN

342 Don't underestimate the effect of an unsound sales budget on production efficiency. Inaccurate forecasts mean fluctuating schedules, a changing work force, and low worker morale.

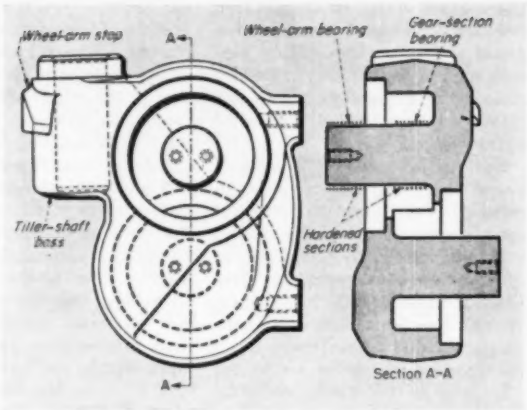
343 Study merchandising's technique for introducing a new product. It'll pay you to try the same methods when installing new equipment. You'll avoid resistance not only from workers but also from foremen.

344 Build a good reputation in your community. Morale and efficiency usually are high in the plant that is known as "a good place to work."

345 Remember that human problems need careful study just as do engineering problems. Man is multi-motivated and one prescription won't cure all his ills.



TRACTOR WEIGHT is carried through tiller shaft to knuckle housing to wheel-support arms. Gear teeth on arms mesh with each other to synchronize reverse motion of wheels as tractor goes over rough ground



KNUCKLE HOUSING has two spud shafts pointed in opposite directions and aligned parallel within 0.005 in. Spud-machining is done from alternate faces of housing in similar, but not exactly the same setups

HOLLOW GRINDING FINISHES SPUDS

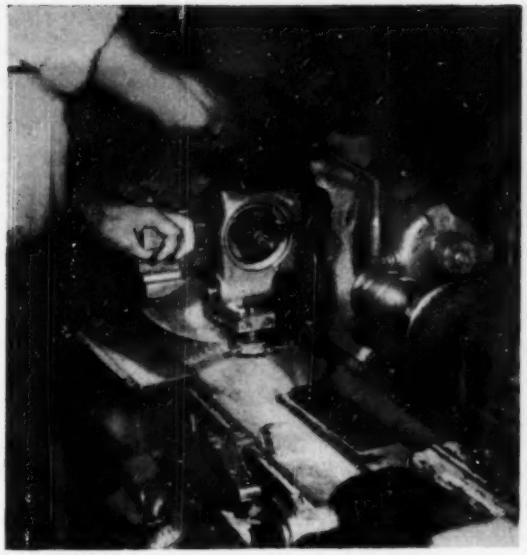
BY JOHN LUND, SUPT., MANUFACTURING EQUIPMENT AND PROCESSES, JOHN DEERE WATERLOO TRACTOR WORKS

HOLLOW MILLING cuts spuds to depth in two operations on same machine with heavy, four-tooth cutter. Alternate chucks on eight-station Bullard are tooled for alternate sides of the forged parts

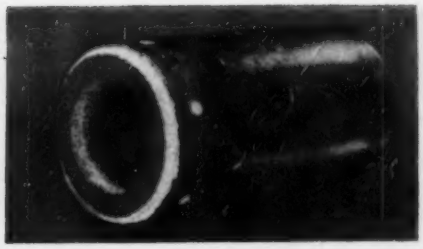
A front-end knuckle housing, forged to carry swinging wheel-support arms on Roll-O-Matic knee actions, has two spud shafts that are enclosed except at one end by the housing itself. All machining and heat-treating had to be planned to work from the open ends

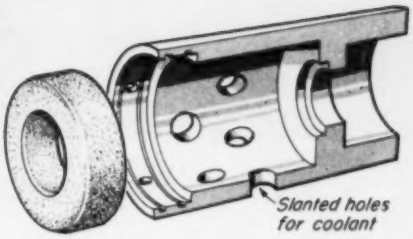
OPTIONAL front-wheel mounts for some John Deere tractors synchronize vertical wheel movement so one of the wheels can go over an obstruction as high as 5 in. without throwing off the load distribution between the wheels. The two front wheels, which are mounted close together, swing on arms that pivot in a knuckle housing that also carries gear sectors which force one wheel down as the other rises.

Spuds that pivot the wheel-support arms are almost enclosed in the forged knuckle housing, which is symmetrical except for a boss that fits the normal tractor tiller shaft. Although the spuds are offset 3.613-3.618 in. from each other, they must be parallel, machined accurately, and hardened where the wheel-support arm and the gear sector bear on each one. Production operations were set up so hollow milling, hollow grinding, and heat-treating could be



HOLLOW GRINDING finishes spuds on counterweighted faceplate with spud centered with dial indicator. Work speed is 80 rpm, wheel speed is 10,000 rpm. Two setups on Heald grinders do alternate spuds





GRINDING WHEEL for slow-feed job is locked into round adapter by molten sulphur, which keys into two grooves and six small holes. Large holes in adapter are slanted to pump coolant into wheel bore

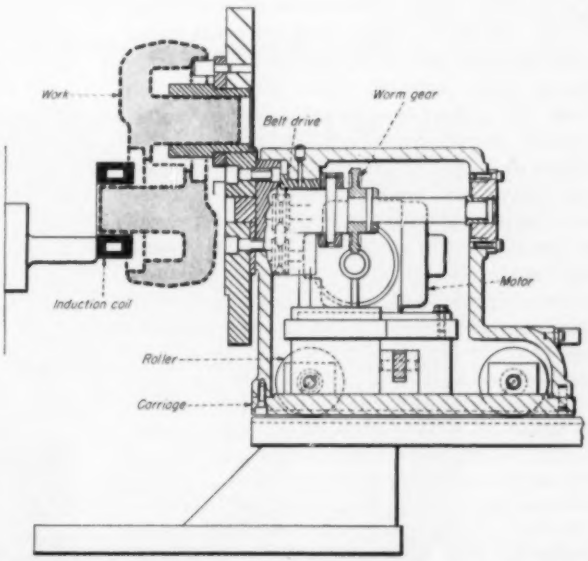
done from the open ends in alternate setups with tools working from the open ends of the housings.

Four chucks on a Bullard Type B machine hold rough forgings for the first (milling) operation. Similar chucks on the other four stations locate machined spuds in bushings while the opposite spuds are cut.

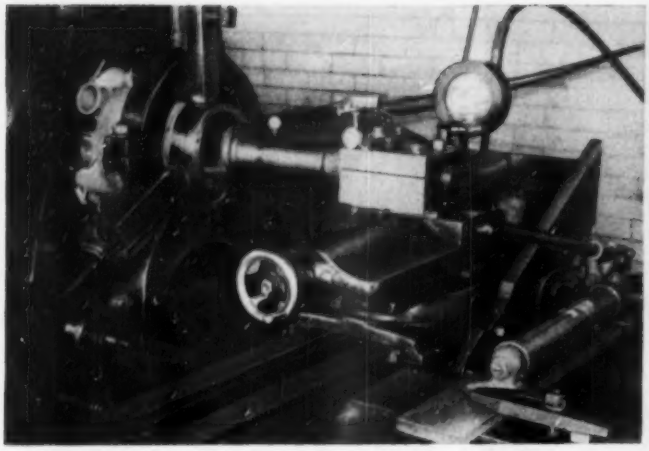
A cup adapter for the second (grinding) operation holds a grinding wheel that finish-machines the shafts. This, in place of a small-diameter wheel in a conventional setup, cut cost and time. Normal drilling operations are performed, and the tiller-shaft boss is machined, before hardening and final grinding are done.

In all cases, fixtures can chuck either side of the housings, but for the grinding job two machines are set up. Here the problems of balance make it desirable to have exactly counterweighted chucks, so identical fixtures on the two machines are fitted with lead weights.

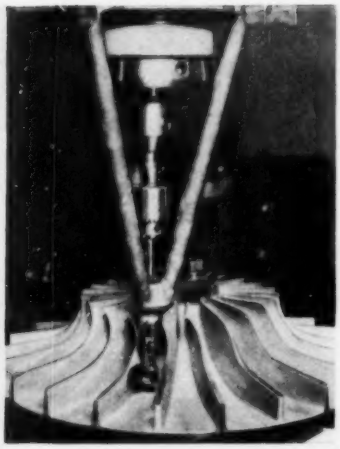
Hardening on the spud shafts is designed for 56 Rc on both bearing surfaces and a minimum of 50 Rc at a ⅛-in. depth.



INDUCTION HARDENING conditions two bearing areas on each spud shaft for hard wear. Fixture slides to two positions to locate heating coil around shaft in two spots. Motor rotates work at 17 rpm through two worm reductions to assure even heating. Test readings after Tocco heating-and-quenching cycle shows 56 Rc. Finish grinding completes job



Knurling the inside of a cylinder barrel for improved lubrication. A hydraulic jack is used to supply 1000 psi to a 5-in. cylinder to force the knurl into the special high-alloy steel barrel. Lathe frame was specially reinforced to resist the imposed load of 10 to 15 tons tending to spread the bed, and a heavy-duty steadyrest supports the work against the thrust

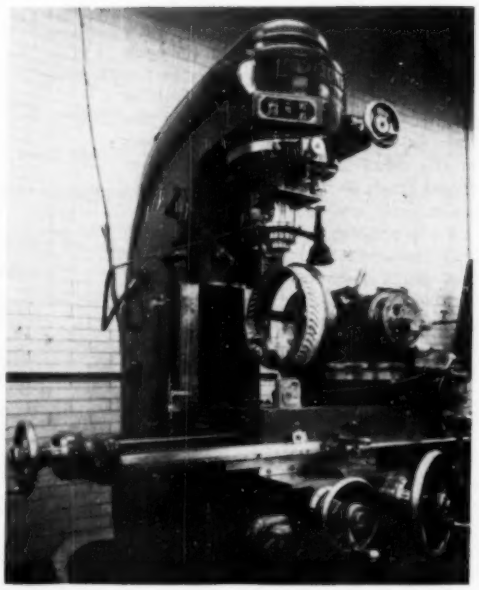


Drilling tiny holes through supercharger impeller vanes was impossible with standard equipment. In this setup, a dentist's drill is supported in a tripod mount clamped to the spindle housing of a lig borer

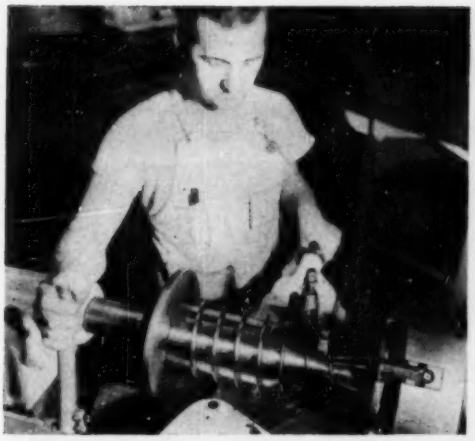
INGENUITY SOLVES TOUGH

RESEARCH center for the entire aviation industry, the Lewis Flight Propulsion Laboratory of the National Advisory Committee for Aeronautics has no more important section than its machine shop. Although it is equipped with the finest of modern machine tools, and staffed with highly skilled toolmakers and machinists, it operates under the unusual condition of manufacturing, generally, only one piece of a kind. Work is rarely, if ever, put to practical use in an airplane or engine. Instead, it is used by the engineering staff to find the answers to the many perplexing problems involved in the science of aviation; answers which may not be needed for 10 or 20 years, but which must be available when the need arises.

Frequently, parts are made to an enlarged scale to permit the researchers to obtain air-flow characteristics or other data over areas too small to be instrumented in natural size. This, in turn, introduces some awkward machining and fabrication problems that must be overcome by the use of considerable ingenuity. And while every machine is equipped by its maker with every standard accessory, new accessories and special modifications are frequently developed by the shop itself to meet the extraordinary conditions continually encountered.



Rotary-head K & T die sinker with 22 in. between table and spindle tip has astronomical divider and rotary table for milling radial profiles in blade support members. Each contour has six radii

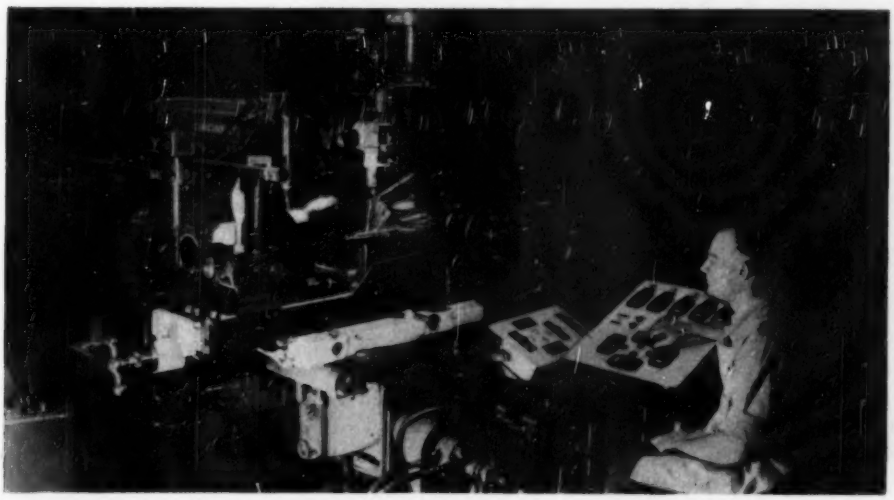


Helical fin for a rocket motor has varying pitch, height and diameter. Model was produced by turning the body to shape and tack welding a steel strip into the required position. Finished part was made on a Hendey lathe with a Bailey duplicator, using the model as a master

Supercharger impeller is built oversize to permit installation of pressure pickups to measure static and dynamic pressure at various points. Readings are taken through tubes seen projecting around the shaft. Research program on this will take 5 years

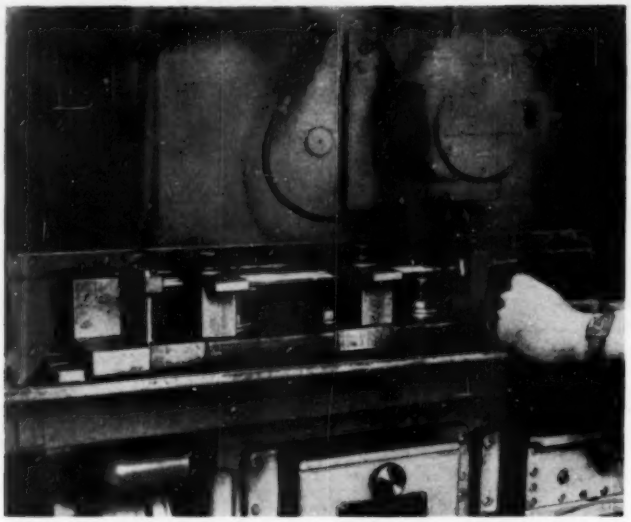
MACHINING PROBLEMS

Close-tolerance, complex forms are produced on a one-of-a-kind basis at NACA machine shop where engineers and toolmakers work as a closely coordinated research team

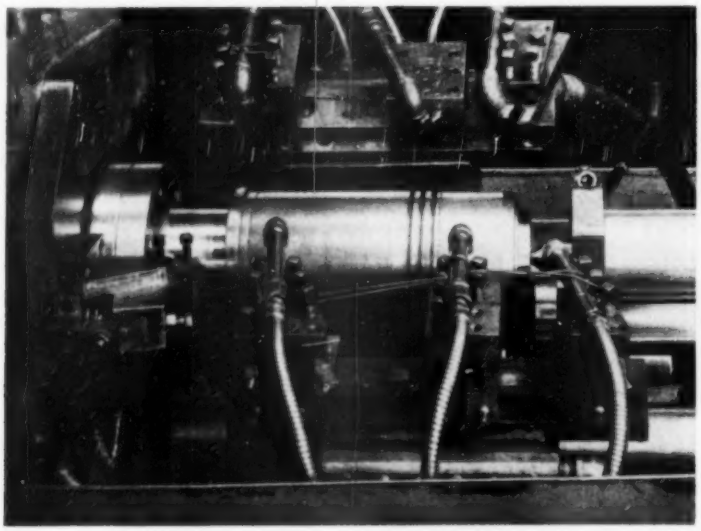


Four-dimensional machining is achieved with a Bridgeport head mounted on a Cincinnati mill. Dividing head provides work rotation, and three templets, each with its own stylus, are employed simultaneously to produce the contours required to create impeller vanes

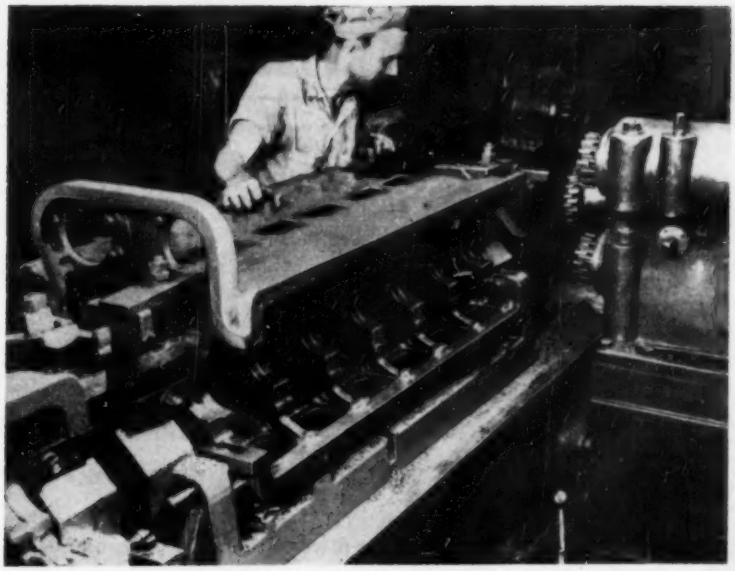
TALENTED TOOLING AT CUMMINS ENGINE



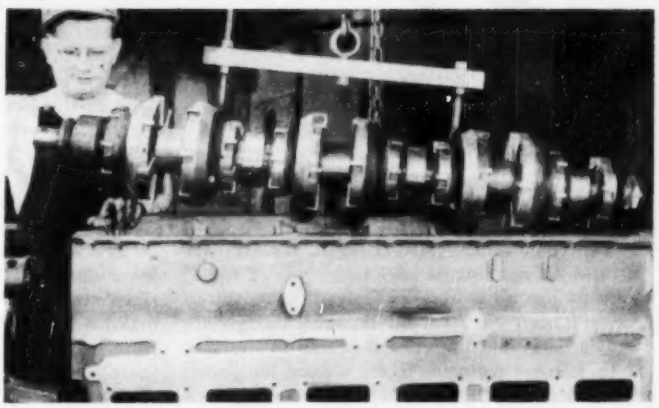
MILLING CUTTER JUMPS CLAMP during cycle that end-mills straight, interrupted keyway in fuel-pump shaft. Cincinnati O-8 automatic rapid-traverses table to first position, feeds cutter down to depth, slow-travels for slot lengths, retracts cutter, shifts to second slot, repeats for three slots, then backs to starting position for unloading. Operator only loads, unloads, and starts cycle



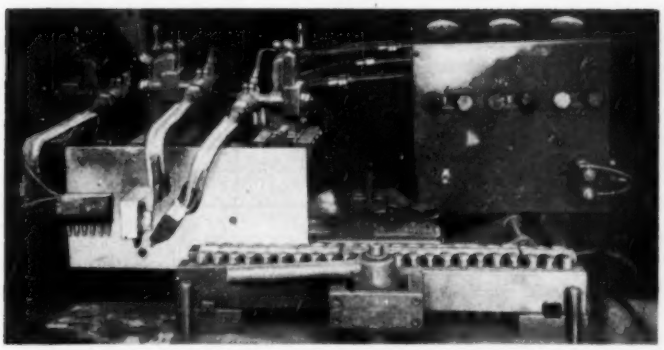
MULTIPLE TOOLING CUTS CYLINDER LINER in 12x21 Fay automatic lathe that holds work on air-operated mandrel. Four tools on front side turn OD, then rear-slide tooling cuts three grooves and straddle-faces flange at left. Head-mounted spring tool counterbores 0.01 in. and chamfers. Material is No. 10 SAE cast iron



DUPLEX MILL FACES CYLINDER BLOCKS with carbide-tipped cutters on six spindles. Two blocks are carried on 16-ft table that feeds at 6 ipm. Top and bottom, as well as main bearing pads, are roughed and finished at 350 sfpm. Oil-pan surface is held to 125 microinches rms



ONE ARBOR CARRIES ALL CUTTERS for facing main crankcase bearings. Cylinder block is loaded on milling machine, then loaded arbor is dropped into place and locked with machine spindle. Endwise table movement between two stops works first left, then right, carbide cutters into block. Thrust bearing alone requires further machining. Method gives maximum accuracy, uniformity, and simplicity of setup for low production



"PUDDLER" APPLIES STELLITE TO VALVE CROSSHEADS where rocker arms bear against them, increasing wear resistance. Machine developed by Haynes Stellite has preheating head with six nozzles followed by dual-nozzle head. Flames are inclined 15° inward at this head and Stellite rod is fed in between. Third head has flame that keeps puddle hot and allows slow cooling. Burners and feed rod are moved over bank of 24 crossheads at 2 ipm

ROUND TABLE

Whose Business?

"You're looking mighty happy this morning, Al. What happened? Get a raise or something?"

"Not exactly, Ed, but I just heard from the Old Man that we latched on to a thumping big order today. A hundred grand. I think he ought to tell all the boys about it."

"Oh, yeah — and have them all hollerin' for a raise on account of it! I think you're nuts."

"Now just a minute, Ed. They all know things haven't been too good lately, even though nobody's been laid off. And it seems to me that if they knew we were in for a good long spell of steady work, it would make them feel a whole lot better. After all, there's nothing like a feeling of security."

"Oh, sure! But they'd also know they had the Old Man where they wanted him. If he doesn't give 'em a raise, they'll quit, and he'll lose his shirt."

"Yeah! And if he does give them a raise, he'll lose it anyhow. He had to bid mighty close to get the order. But if he told them that, and explained that it was a case of get the order or close the plant, I'm sure they'd see it his way. After all, they're reasonable guys."

"Mebbe so, but what business is it of theirs anyhow? They're just paid to work; it's the boss' job to get the orders, isn't it?"

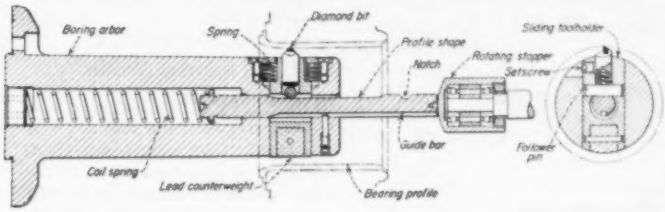
"For Pete's sake, Ed! Do you think you're back in the Middle Ages or something? Keeping the business going is everybody's job."

"Well, I can't see it that way. Seems to me that what goes on in the front office is no concern of the fellows in the shop. All they have to do is to stick to their knittin'."

"That's just where you're wrong, Ed. You know darn well that we need three new lathes right now, and if we can't keep working and making a profit, where's the money coming from to buy them? And if we don't buy them, there's going to be three guys out of a job pretty soon. And I still say there'd be a whole lot better feeling around here if the guys knew the work was rolling in. Look at Bill, for example. He was going to buy a television set, but when things began to ease off he got kind of scared and cancelled the order. Now if he knew we'd be working steady for the next six months, he'd go ahead and buy it, and that would mean more work for the guys at the television plant. It's just simple economics, Ed."

IS IT GOOD BUSINESS to let the men in the shop know what new orders are coming in? Or is Ed right in saying it is no concern of theirs? Do men understand the boss' difficulties, and are they willing to go along without snatching for every last nickel? Reactions to earlier topics appear on later pages.

Practical Ideas



Profile Boring Tool Has Cam Inside Arbor

TO FINISH the inside diameters of heavy-load bushings, which must be formed to a bell-mouth section at both ends, we employ an unusual boring arbor that works in an Ex-Cell-O single-spindle precision boring machine.

A guide bar, which is also the cam for the shape inside the bearing, works inside the boring arbor. A coil spring that butts against a plug in the end of the hole through the arbor works against a faced shoulder on the left end of the bar. This bar works inside two bored-out bearings in the end of the arbor, so it cannot wiggle.

Through the end of the arbor a slot is formed, and this confines the spring-loaded toolholder. A diamond bit is clamped in the holder by a setscrew that exerts side pressure. For removal purposes, the diamond toolbit is backed by a compression spring which will force it out when the setscrew is released.

The sliding toolholder is held down against the profile shape of the guide bar by two springs that are backed by a plate screwed into a recess in the arbor. A lead counterweight on the opposite end of the toolholder balances the rotating arbor. To keep the guide bar rotating with the arbor a small threaded pin is inserted in the bottom of the arbor to extend into a keyway along the guide bar.

As the arbor rotates inside the fixed bearing, which is clamped to the machine table, it is fed through. The rotating stopper is fitted with ball bearings to reduce friction as much as possible. The arbor is brought out until the end of the guide bar contacts the stopper (which could be a live tailstock center). Further feeding causes the arbor to override the guide bar, which brings the ball that guides the toolholder over the profile shape. The shape is ground accurately to the same size as the bearing, so the toolbit is adjusted in its radial position so it will form the bearing to the same profile as that on the guide bar.

A small notch near the end of the guide bar allows the ball that backs up the toolholder to drop away from the bearing when the arbor reaches the end of its travel. The arbor can then be withdrawn back through the bearing with the toolbit retracted so it will not mark the bearing. The notch also holds the guide bar inside the arbor when the assembly is out of the lathe so the bar will not be likely to get damaged.

Because of the long length of the guide bar, many form-boring jobs can be done with a similar setup. Once the form or profile is ground, the bar can be assembled inside the arbor. Adjustments for longitudinal position can be made by shifting the rotating stopper. *Nobuo Arakawa, Tokyo, Japan.*

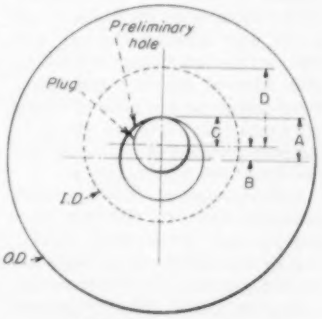
Eccentric Rings Bored In Plug-Located Setup

TURNING AND BORING eccentric rings usually calls for good layout before the work can be machined. Here is an alternate method which requires only a little extra machining, but which eliminates all layout.

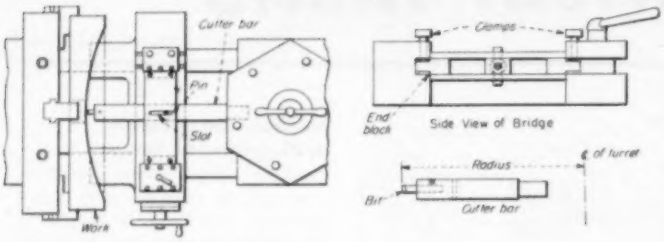
We had a number of small rings to be turned and bored eccentrically. First we bored out small preliminary holes and turned the 3-in. OD. Then we chucked some bar stock in a collet and turned down a plug, after determining the diameter by the formula below. Finally, we mounted a faceplate on the headstock over the collet, with the plug projecting through the center hole of the plate, and located the rings with an edge of the preliminary hole contacting the plug. The plug was removed, and the final ID of 2 in. was bored out.

The preliminary hole had a 1-in. dia, the offset required was 0.1875 in., and the plug dia was 0.625 in. We picked 1 in. for the small hole because this dimension was smaller than the 2-in. ID less twice the offset and more than twice the offset distance. The plug dia worked out to 0.625 in. (1.00 —2x0.1875 in.).

This method is faster than the conventional layout system, and can often be more accurate. *Hugh Hay, Elmira, N. Y.*



$2C = 2A - 2B$



Turret-Lathe Tooling Faces Large Radii in Castings

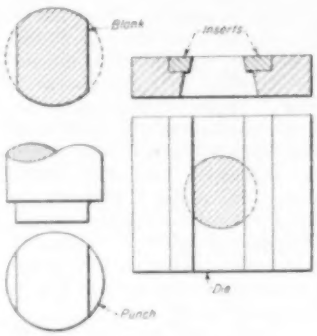
CUTTING CASTINGS to a large radius was required on a job not long ago. This was done with a minimum of equipment by a setup on a turret lathe where the cross-slide drove the cutting tool.

First a cutter bar was made by turning one end of a square-section bar to fit in a turret hole. A toolbit was mounted in the other end of the bar after the bar had been slotted and drilled and tapped for a setscrew. The length of the bar was determined so the toolbit, a conventional lathe tool, would cut the required radius with the center of the turret acting as the center of the radius.

Next a bridge across the slide from the front toolpost to the rear one was made. This was two flat pieces of steel separated by end blocks. The blocks were bolted down on the toolposts. In the center of the bridge, a slot was cut through both flats.

An assembly was made with the toolbar through the middle of the bridge. A hole had been drilled vertically through the toolbar, and a pin was dropped through this hole and the two slots in the bridge. This allowed forward and backward motion of the slide to swing the tool in an arc when the toolbar was clamped in the turret and the turret was free to rotate.

Slots through the flats were necessary to prevent the pin from binding and preventing motion. During the cutting cycle, the toolbit was started from the front and swung to center. Because the pin shifted to the right-hand end of the slots in the bridge as the tool came to center, the turret could be backed up slightly to allow clearance for removing the work from the chuck. *Allan Clarke, Lancashire, England.*



Sectional Dies Simplify Odd-Shape Blanking

A RECENT ORDER called for circular blanks punched from sheet stock, to be shaped as though two unequal segments had been cut away. We realized a sensible economy of time and labor by forming the die with inserts.

The circular die blank was bored out on a lathe, and was formed with our conventional ½° draft. Then two shoulders or notches were shaped across the top of the die. Two tool-steel bars were machined to the right shape and draft and screwed into the notches across the die hole, and were finally milled off flush with the top of the die. The bars were held in place by alignment pins and long screws.

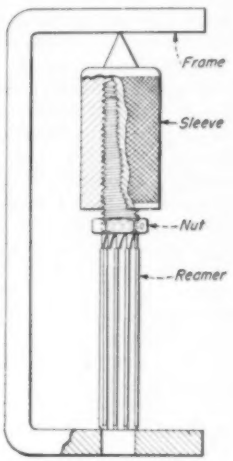
The punch was easier to make, requiring only turning and then shaping off two flats to the required dimensions. *Federico Strasser, Santiago de Chile.*

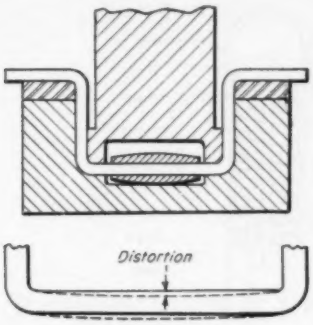
Modified Reamer Works In Close Quarters

SEVERAL TRUCKS came into our shop recently to have loose frame rivets replaced by heat-treated bolts. The holes had to be reamed out to close tolerances for a dowel fit with the bolts, but half of them were on the sides of U-shaped frame members and they were hard to get at.

We made out by fitting a standard hand reamer to work inside the U-beams. A knurled sleeve was threaded inside to fit the threaded shank of the reamer. On the closed end of the sleeve, a hardened point was ground, and a nut was pinned to the reamer shank at the other end of the sleeve.

By holding the knurled sleeve with one hand and turning the reamer by means of the nut pinned to the shank, the reamer was forced through each hole. Any tendency to bind was stopped by letting the reamer clear itself by letting the knurled sleeve ride along with the reamer shank, thus pivoting about the hardened point. *M/Sgt. James R. Wood, APO, Seattle, Wash.*



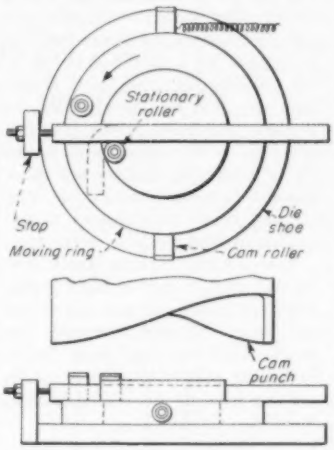


Rotary Punch Bends Brace Handles

IT WAS FOUND impossible to bend brace handles in a conventional press setup without introducing distortion and springback in the straight shank which held the hand grip. To form the ⅜-in. cold-drawn rod to the required shape, it was necessary to resort to a rotating punch which was not as economical, but which produced a good product.

A round die block, ¼ in. high, was located on a round shoe in a 45-ton press with a 4-in. stroke. The block was grooved across the top to locate the stock so it would butt against an adjustable stop to the left of the die. A hardened roller was screwed down to the die next to the left end of the groove to pivot the brace handle; and a steel ring, also fitted with a roller, was made to slip over the die. Bending was accomplished between these two rollers.

Two larger, stronger rollers were screwed into the outside edge, opposite each other, of the ring to meet the double-cam-shaped punch. As the punch stroked with the press ram, it hit these rollers and rotated the ring counter-clockwise—thus bending the stock in one place. With this method, only one bend could be made at a time.



Angular adjustment of the bend was made by raising or lowering the relative position of the cam when it hit the bottom of the ram stroke. *Joseph Budnick, Bellerose, N. Y.*

Making Carbide Scribers

BRAZING a piece of scrap carbide to a steel shank is not the most effective method for making a carbide scriber. The process is often difficult, and the brazing often cracks the carbide.

A better method is to turn and bore a shank from steel, aluminum, or brass to take a piece of 1/16-in. extruded carbide stock in a press fit. Such carbide stock is available at about $.20 per inch.

The metal shank can be drilled in one end, or bored out so the carbide will stay in place once it is put there. The hole should be about 0.001 to 0.002 in. smaller than the carbide.

If larger carbide stock is available, suitable scribers can be made by simply grinding off a convenient pencil length and then grinding the end to a point. This is, of course, more expensive. *Basil Clark, Evansville, Ind.*

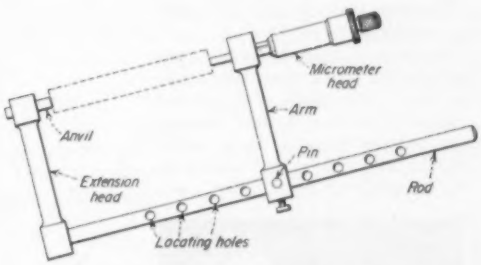
Micrometer Tool Spans 10-in. Size Range

FITTED with a standard micrometer head, this adapter allows measuring large and small pieces, and has unusually large clearance for flanges.

The frame is built up from a long, ground rod that is drilled accurately at 1-in. intervals. This is attached to an extension head which is rigid and strong. A hardened, ground, and lapped anvil is pressed into the end of this head to match against the micrometer unit, which is mounted in a similar arm.

At the bottom of the micrometer-carrying arm a setscrew is fitted to clamp against the ground rod, and a ground locating pin is provided to slip through the bottom hub on this arm and through the holes in the rod.

During construction, it may be advisable to drill the long arm first, using the most accurate method at hand, and then fit the end with some sort of adjustment screw which will allow setting the anvil



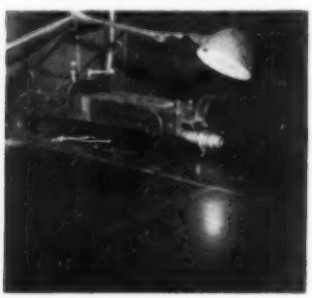
at the right distance from the micrometer spindle. The tool can be set by slipping the micrometer arm to the 0-to-1-in. hole in the rod, slipping the pin in place and tightening the setscrew, then turning the micrometer spindle full out to the zero mark. Adjustments can be made at the junction between the vertical anvil arm and the rod. If the holes through the rod are spaced right, the micrometer will read correctly at any position. *Ben Goodwin, London, England.*

Beading Machine Converted Into Rubber Cutter

TO MAKE CURTAINS, liners, and seals for airless and air-blast cleaning machines it is necessary to cut rubber sheet accurately and with well-defined edges. We took an old beading machine, added an extension shaft to provide a deeper throat, and attached cutting blades.

The beading dies were replaced with cutters made by taking old circular-saw blades and grinding them down to a 3-in. diameter. The top blade, which works above the table, is sharpened to the right. The lower blade, under the table, is sharpened to the left.

Rubber is guided through the cutters by following previously marked lines. Both straight and curved lines can be cut because the cutters have a fairly small radius. The cutters are rotated by the spindles when a pedal is depressed. Rubber sheet up to ½ in. thick can be cut. *M. E. Frazee, American Wheelabrator & Equip't Corp., South Bend, Ind.*

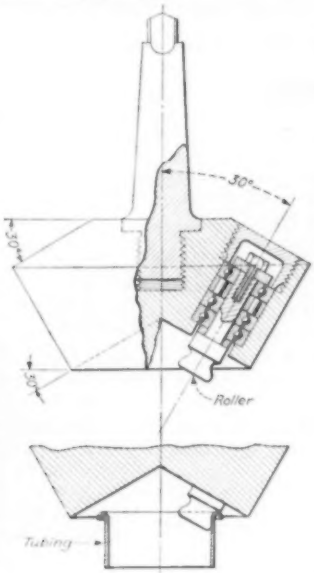


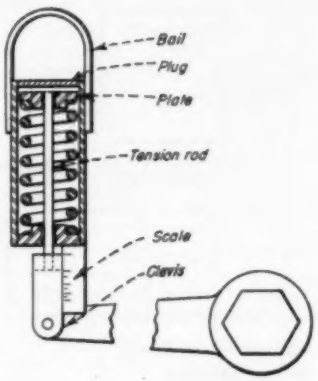
Curling Tool Beads Tubing

INSTALLED in the spindle of either a lathe or drillpress, this rotating tool performs a function that is difficult to do in a press, although the operation is a press function.

Three rollers are spaced evenly around the circular tool. Each is assembled with suitable ball bearings to take both radial and axial thrust. The spindle assembly for each is made so the lower bearing is stopped by a shoulder bored in the hole through the body. Bearings are held on the spindles by washers and bolts driven into the spindles. A threaded insert in the top of each hole confines the spindle-and-bearing assemblies. The tapered shank is threaded to assemble in a tapped hole in the tool.

The round curling tools are formed so they can be fed directly down on the work and will form the beads without breaking the stock. This tool has been found to be the best and most accurate for this kind of job. *Peter Lashta, Montreal, Quebec.*





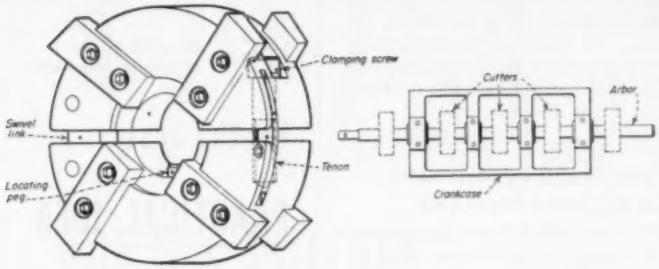
Tension Equalizer Works From Shop Crane

LARGE BOLTS, tie rods, and locknuts on heavy equipment are tightened to equal tension with a torque scale which is really an oversize torque wrench. The unit is operated from an electric hoist, crane, mechanical hoist or a chain block.

Tubing with a 4-in. diameter was cut to form the outside body of the equalizer. Inside the tube a strong compression spring was assembled. This works between a plug in the bottom of the tube and a round plate which is threaded onto the tension rod. A top plate seals the tube, and a bail over the top of the tube is provided to catch the crane hook.

At the bottom of the tension rod a clevis is attached. To this a wrench can be fitted to handle any size of bolts or nuts. The original equalizer had an arm that was 36 in. long, and the spring was capable of carrying a load of 4000 lb. By attaching a number of known weights to the end of the tension rod before the wrench was added, it was possible to graduate the scale, which was attached to the bottom of the tube.

For heavy equipment, where bolts must stand high tension, the equalizer is a good tool to have. The tension on all bolts can be drawn up to the same point on the scale, which will evenly distribute the load and prevent many bolt failures. *Charles R. Begor, Jr., National Lead Co., Tahawus, N. Y.*



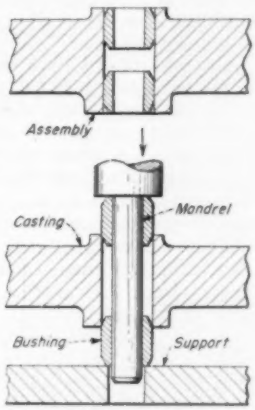
Hinged Cutters Clamp Over Boring Bar

INTERNAL FACES and the supporting webs of crankcase main bearings for engine castings must be faced to accurate dimensions. The old way to do this is to feed an arbor longitudinally through the crankcase and through the cutters which are held in the openings, then clamp the cutters. A quicker method is to make a number of hinged cutters which can be clamped around the arbor after it has been inserted.

Round cutter bodies are machined out of solid stock. Both faces are grooved to hold inserted toolbits, and suitable setscrew and bolt holes are drilled and tapped. Then two opposing slots are cut in the edges of the cutter. These are to admit a swivel hinge link and a positioning tenon. After this machining has been done, the bore of the cutter is accurately ground to the OD of the boring bar or arbor.

The cutter body is cut in half with an abrasive wheel or a saw, and the swivel link is inserted and held in place by two press-fitted pins. The flat positioning tenon, or key, is also held by a pin. Clamping is done with a capscrew that assembles through a milled slot and drilled - and - tapped hole through both halves of the cutter. In the bore, in one half of the cutter, a hardened and ground pin is assembled to key in a suitable hole drilled in the boring bar.

Accurate spacing of the slots that hold the toolbits is essential, as is fairly accurate machining all over the cutter. The assembly can be utilized on a horizontal-spindle boring machine or milling machine. *R. B. Wolverhampton, Staffordshire, England.*



Press Mandrel Fits Two Bushings at Once

MANUFACTURERS often specify that two short bushings are to be pressed into a long bore that could take one long bushing. This normally is to save cost because two standard bushings can be utilized in a place where a special costly bushing might have to be fitted. But costs can be high, even if standard bushings are inserted, unless efficient pressing methods are followed.

For two such bushings to be installed in a casting, one good way to do the job is to equip a bench press with a mandrel that will work in a drilled support. The bushings are started in the bore by hand, then the casting is centered over the support hole and the mandrel is brought down. End pressure from the mandrel and the support will force both bushings into place.

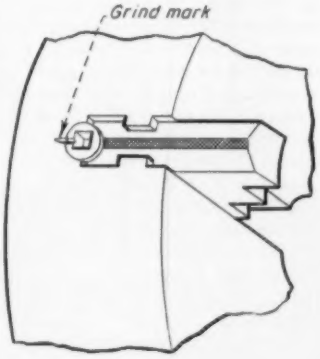
The hole in the support is slightly larger than the OD of the mandrel, and the mandrel is ground to a slip fit in the bushings. *H. G. Frommer, Milwaukee, Wis.*

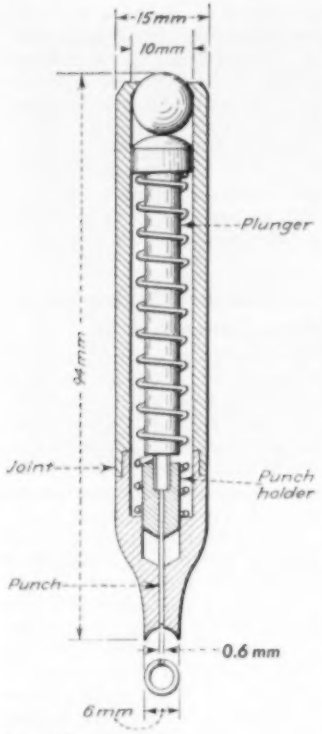
Indicated and Ground Jaws Make Centering Easy

THIS MAY BE AN OLDIE for a lot of shop men, but I was surprised at how many men around our shop had not heard of it. To make centering on a four-jaw independent chuck easy, index marks can be ground on the adjusting screws on each jaw.

First a machined piece of round stock is clamped. It should be 8 to 10 in. long so it can be centered with a dial indicator at two places, thus insuring concentricity with the chuck. Then, after the stock is centered as accurately as possible, a 1/16-in. parting wheel is chucked in a small hand grinder and a mark is ground across each socket head on each jaw. This mark should be located in the same relative position on each socket—for example, at 9 o'clock.

When later setups are made, the jaws can be tightened down so each socket matches against each grinder mark on the jaw. Only one mark on each jaw is needed. *Joe Hadley, Shreveport, La.*





Hand Punch Pierces Small Holes in Tubing

SMALL SIDE HOLES had to be pierced through the walls of some lengths of 6-millimeter tubing. These were to be 0.6 mm in diameter, and had to go through 1-mm tubing walls, so the punch had to deliver a sharp, quick blow.

The body of the tool was constructed by boring out two sections as illustrated, then pressing them together after the inside parts had been inserted. The punch was ground to 0.6 mm, and was held in a collar-like adapter that fitted the end of a plunger. A spring held the plunger up against a round ball, which, in turn, was confined inside the body by a lip edge left in the boring operation. The working end of the body was bored to closely fit the curve of the tubing, so the punch was automatically centered when the body was held against the tubing.

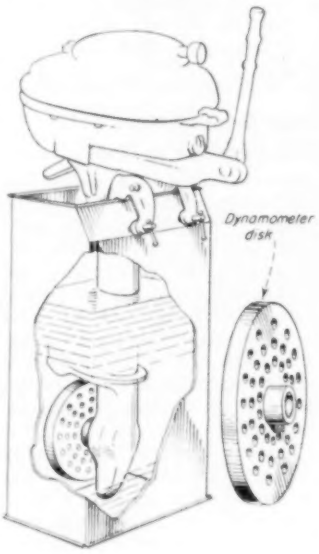
A sharp hammer blow against the ball delivered enough force to the punch to pierce the tubing. In case the punch broke, disassembly was easy and the punch could be readily replaced. *Georges Roseline, La Hulpe, Belgium.*

Disk Acts as Dynamometer In Outboard-Motor Test

RUNNING POWER TESTS are given to outboard motors before they are packed for shipment. In order to provide a load that will simulate actual running conditions on a boat, steel disks are attached to the drive spindles instead of propellers, and the motors are set in a tank of water.

The disk, determined experimentally, is 9 in. in diameter, ½ in. thick, and has a number of holes drilled around in concentric circles. When carburetor, ignition, and other adjustments have been made, the motor is operated at full power—wide open. The disk should revolve at 4000 rpm, and if it does not, test operators know further adjustments must be made. Speed can be checked with a stroboscope.

Water is not thrown by the disk, and the holes make it cool-running by circulating the water. *Chester S. Ricker, Grosse Pointe, Mich.*



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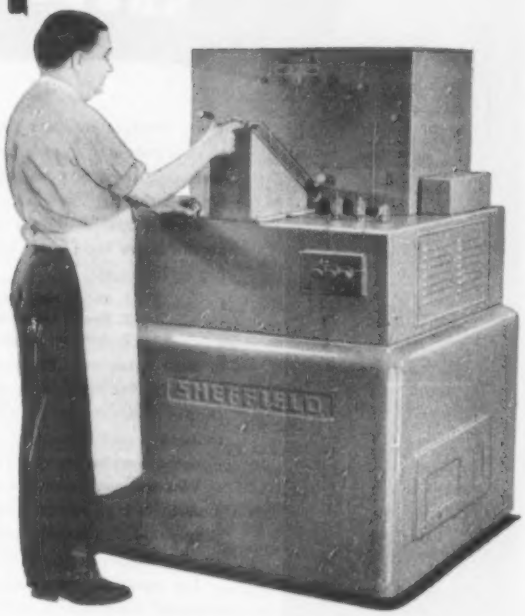

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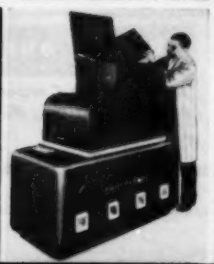

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Soft Grits for Blast Cleaning

Losses of machined parts from poorly chosen cleaning methods may be minimized or eliminated by use of soft grits prepared from corn cobs, nut shells and fruit pits. These grits, mixed or not with rice hulls, are used in conventional sandblasting equipment. Efficient removal of paint, dirt, grease, carbonaceous deposits and scale, is accomplished without impairing or changing the surface or dimensions of the metal workpieces.

The use of such grits gained impetus during the war, when both military and manufacturing organizations found a number of applications for them. And continued industrial interest prompted the Northern Regional Research Laboratory, U.S. Dept. of Agriculture, to make further experiments to determine the efficiency and durability of soft grits produced from eleven agricultural residues. See table.

In reporting the tests, T. F. Clark and E. C. Lathrop said that the grits or grit-hull mixtures were blasted against steel panels coated with six layers of baked-on, resin-base paint until the paint film was penetrated. The time in seconds for penetration was taken as the measure of cleaning efficiency. During the tests, the nozzle was held 3 in. from the panels, and compressed air at 90 psi was used. Mixtures of grits and rice hulls were in proportions of nine parts shell grits and five parts rice hulls.

When a mixture of shell grits and rice hulls was blasted upon aluminum and brass panels, a satin finish resulted.

Welding scale was effectively removed from fabricated steel plate, and the cleaned metal surface was considered satisfactory for painting. No pitting occurred, as with steel grits, to cause early failure of paint films.

Polishing of metal surfaces by means of soft-grit blasting is not recommended at present, if gloss or high luster are required. Modification of grits and experiments with the angle of impingement, quantity and size of grits might result, however, in acceptable polishing and burnishing procedures. Hot-dipped tin and other platings acquire a satin finish under extremely mild blasting conditions. Blast cleaning of metal surfaces prior to plating or galvanizing should be feasible.

Equipment and machines covered with deposits of grease, oil, or dirt, as well as metal preservatives or rust-prevention compounds, are readily cleaned by soft-grit blasting. The greases, gums, waxes, asphalts or varnishes present in preservatives cause no difficulty. It is economical to discard the grits after one application for removal of such contaminants, and it is possible to obtain lower costs than with solvents.

Modifications of the blasting technique are permissible. Combinations of grits and hulls may range from 90 parts of grits—10 parts rice hulls to 35 parts grits—65 parts rice hulls. Variations in air pressure and angle of impingement on the work surface change the character of the surface finish produced.

Tests show that durability of grits produced from nut shells and fruit pits is somewhat less than for clean, dust-free corncob grits, but that the cleaning rate and efficiency are greater.

Electrical equipment, especially motors and generators, can be cleaned and degreased effectively. Preferred materials are corncob grits and hardwood sawdust, in No. 20-60 sieve sizes, because of their efficiency and absorbency. The time required for cleaning such equipment is only one-fourth to one-third that required by other methods and long periods of drying are not required before the equipment can be restored to service.

Effectiveness of grits is the same regardless of the size of the object to be cleaned. If objects are too large to be placed in a conventional booth, portable blast units can be brought to the work. Since the low cost of the grits allows for their disposal after one use, no elaborate shielding is required. Only persons within a 10-ft. radius of the scene of blasting need wear protective devices.

Grits should be obtained from sources that carefully remove tramp metal and other contaminants from the raw material before grinding, and which also pass the finished grits over a magnetic separator.

Efficiency of Soft Grits for Blasting Paint Films

(All grits No. 12/30 U. S. Standard sieve sizes)

Type of Grits	Penetration time: Grits only	Penetration time: Grits plus rice hulls	Dust removed in 1 hr.	Total material passing No. 30 sieve: before blasting	Total material passing No. 30 sieve: After 1 hr. blastings
	Sec.	Sec.	%	%	%
Hardshell-almond shell	9	7	2.9	3.2	26.7
Softshell-almond shell	9	7⅓	2.1	3.9	51.2
Apricot-pit shell	11⅓	7⅔	6.2	4.2	31.1
Cherry-pit shell	7	3	39.7	4.1	83.9
Coconut shell	4	4⅓	3.7	5.9	34.7
Corncob, Air-separated	22	20	1.8	1.1	6.2
Filbert shell	6⅓	5⅓	1.3	2.4	28.7
Peach-pit shell	5⅓	5⅓	1.7	4.8	18.6
Pecan shell	5⅔	7	1.2	3.6	12.1
Black-walnut shell	4	4	1.4	3.8	22.0
English-walnut shell	5	5	2.9	0.2	9.4

[a] Dust removed in 1 hour has been included in these values.

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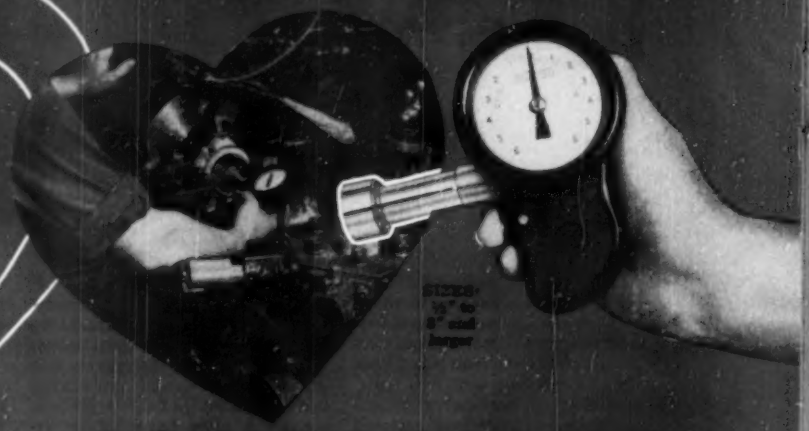

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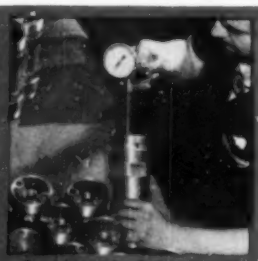

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Shop Application of Hydraulic Cylinders...I

BY WOODROW L. WROBLE, Hydraulic Engineer, WROBLE ENGINEERING CO.

Shop men can apply hydraulic cylinders in many ways to speed up operations, to power fixtures, to build special equipment, and to rejuvenate old machine tools. Accompanying tables and formulas, with a sample calculation, will assist the practical man to use hydraulics.

Cylinders. It is impractical and uneconomical to make hydraulic cylinders, considering the high state of development and reliability of commercial products.

The double-acting cylinder shown in Fig. 1 is used for pressure up to 1500 psi, which is seldom exceeded in machine-shop applications. Various forms of attachments are available for the piston rod. Bores are standardized. Almost any stroke is available.

Certain precautions are necessary when dismantling such cylinders. The cylinder bore is satin smooth. Remove the piston carefully to avoid scoring, also apply the load smoothly. Scored cylinders can be reground and oversize cast-iron rings installed. Self-adjusting chevron packing seal the piston rod. When replacing them, be sure that the same number are put in as taken out, and use only a light force to set the packing. Hydraulic pressure expands the lips of the packing against the bore and the piston rod. And when the piston-rod assembly is removed for installation of new rings, avoid getting dirt on the confined gaskets that seal the cylinder tube to the heads. Replace these gaskets if new ones are available.

If the application is to modernize a machine tool with a chatter-free precision feed, the cylinder shown in Fig. 2 may be required. This device is suitable for pressures to 2000 psi. Because of the higher pressure, as compared to the design in Fig. 1, the cylinder employs a flange packing together with an O-ring to seal the piston-rod end. On this design, the packing nut must be drawn down tight to obtain a compression seal on the edge of the hat packing. The O-rings, being made of synthetic rubber, must be installed carefully.

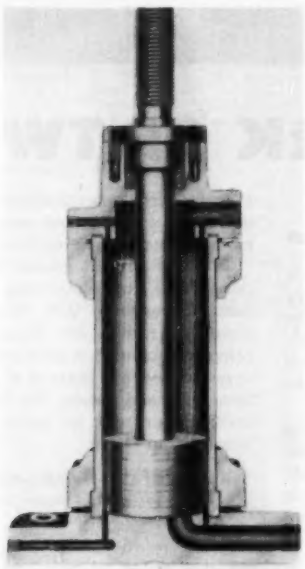
Occasionally the shop man may have use for cylinders, like that shown in Fig. 3 for pressures of 3000 psi or more. This design employs a trunnion mount to allow freedom of cylinder movement. The piston rod is sealed with chevron or V packings and it slides on a heavy bronze guide that serves as a packing gland. The packing is of the mechanical seal type. Use only enough pressure to set it.

Tabular Data. To determine the pipe size suitable for a particular hydraulic system, refer to Table 1. Friction pressure drops are given at various oil velocities and the flows for various pipe sizes, plus loss through fittings. Table 2 gives the output forces of various sizes of cylinders, both push and pull.

Formulas. The following formulas are sufficient for calculations.

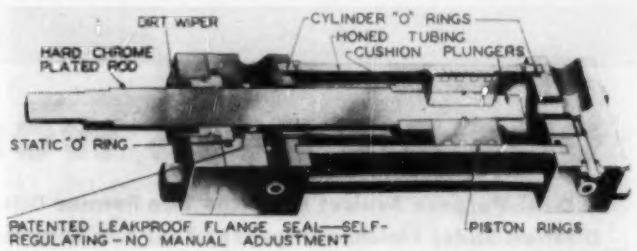
Cylinder force $F = PA$, where F = force in lb; P = unit pressure, psi, and A = piston area, sq in.

Oil delivery Gpm = $AV/231$,



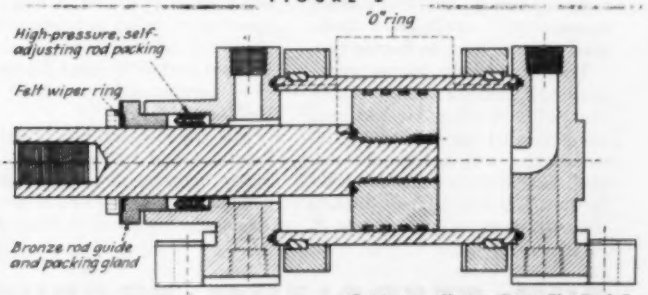
Courtesy . . . Hannifin Corp.

FIGURE 1



Courtesy . . . Miller Motor Co.

FIGURE 2



Courtesy . . . Neptune-Power Plus Prod. Co.

FIGURE 3

ONE OIL DOES WORK OF TWO

Dual-Purpose Sunicut Replaces Two Former Oils; Dilution Ends; Finishes Improve; Tool Life Lengthens

When one oil does work formerly requiring two . . . and with marked superiority . . . it doesn't make good sense to keep on buying two.

That is precisely why a prominent ball bearing manufacturer changed to Sunicut. He had been using one oil for lubricating his automatics, and another for cutting, but without complete satisfaction. The lube oil kept diluting the cutting oil by leaking into it. As a result, he got poor finishes and tool life was short. A Sun representative, called in to study the situation, advised using a dual-purpose grade of Sunicut. Adoption of his recommendation solved the problem.

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Shop Application of Hydraulic Cylinders...II

where A = piston area, sq in, and V = piston velocity, ipm.

Oil velocity in pipes $V = 0.32\ Gpm/A$, where V = oil velocity, fps, and A = internal pipe area, sq in.

Theoretical horsepower $H_t = 0.000583P \times Gpm$, where H_t = approx. input horsepower, P = operating pressure, psi, and Gpm = pump delivery.

Actual horsepower $H_a = H_t \times 100/E$, where E = efficiency of hydraulic pump and system, %.

Sample Calculation. Assume that to modernize a planer-table drive, the hydraulic cylinder must exert a pressure of 3000 lb on the cutting tool, permit a maximum cutting speed of 100 fpm, and operates at 1000 psi. On the cutting stroke, the equivalent pipe length is 12 ft and a four-way valve is used for control. To be found are: (1) size of cylinder, (2) required pump delivery, (3) pipe size, (4) return speed of table, (5) motor horsepower if pump efficiency is 90% and cylinder efficiency is 95%.

Solutions. Cylinder area $A = F/P = 3{,}000 \div 1000 = 3$ sq in. For a 2-in. bore, $A = 3.14$ sq in.

Pump delivery $Gpm = AV/231 = 3.14 \times 100 \times 12 \div 231 = 16.31$.

Pipe size is determined from Table I, knowing Gpm. Oil flow of 16.6 gpm at 10 fps requires ¾-in. pipe.

Pressure drop for 12 ft of pipe, Table 1, equals $12/10 \times 3.70 = 4.44$ psi. Average pressure drop through a four-way valve is 30 psi. Hence, total pressure drop is 34.44 psi. Pump operating pressure equals $1000 \div 34.44 = 1034.44$ psi.

Return speed of the planer table is found by getting the area of the piston at the rod end, from Table 2. This valve is 2.54 in. Hence, return speed $V = Gpm \times 231/A = 16.31 \times 231 \div 2.54 = 1483$ ipm, or 124 fpm.

Pump horsepower $H_t = 0.000583 \times 1034.44 \times 16.31 \div 0.90 \times 0.95 = 11.4$ hp. Inasmuch as the driving motor is not under continuous load, a 10-hp electric motor will serve to drive the pump.

Table 1 . . . *Pipe Size Chart for Hydraulic Cylinders and Systems

PIPE DIMENSIONS			OIL FLOW AND FRICTION PRESSURE DROP FOR 10 FT OF PIPE											
Pipe Size	ID	Area Sq In	Gpm	Drop Psi	Gpm	Drop Psi	Gpm	Drop Psi	Gpm	Drop Psi	Gpm	Drop Psi	Gpm	Drop Psi
½	.622	.304	4.7	1.57	9.4	5.85	14.1	12.15	18.6	20.65	23.5	31.30	28.2	43.4
¾	.824	.533	8.3	1.17	16.6	3.70	24.9	7.10	33.2	15.20	41.5	23.00	49.8	31.7
1	1.049	.864	13.5	0.90	26.9	3.23	40.4	6.73	53.8	11.55	67.3	17.25	80.8	24.4
1¼	1.380	1.495	23.3	0.64	46.5	2.31	69.8	4.88	93.0	7.55	116.3	12.40	139.6	17.4
1½	1.610	2.036	31.7	0.54	63.4	1.81	95.1	4.04	126.8	6.91	158.5	10.42	190.2	14.8
2	2.067	3.355	52.3	0.47	104.5	1.69	156.8	3.60	209.0	6.09	261.3	9.27	313.6	11.1

*Miller Motor Co.

PRESSURE DROP IN FITTINGS (Equiv. Pipe Ft)

Pipe Size	Elbow	Tee	Gate Valve	Globe Valve	Valves 3 & 4 Way
½	1.5	3.3	.34	6.2	12 to 60
¾	2.2	4.6	.46	9.4	20 to 100
1	2.8	5.7	.60	12.4	25 to 125
1¼	3.7	7.8	.81	15.6	30 to 150
1½	4.4	9.2	.92	18.9	40 to 200
2	5.5	12.0	1.20	23.5	50 to 250

Pressure drop shown is for ordinary wrought iron pipe. For smooth new wrought iron pipe, multiply the values shown by 0.7. For very smooth straight tubing, multiply the values shown by 0.54. The pressure drop is the same regardless of operating pressure. Avoid large pressure drops in low pressure systems. Oil flows through large pipes at high velocity (up to 30 fps) with small pressure loss.

Table 2 . . . *Piston Areas, Fluid Displacements and Output Forces for Cylinders with Standard Piston Rod

Bore Size In.	Piston Areas Sq In		Fluid Displacement per In. Stroke Cu In		Approximate Output Forces							
					250 Psi		500 Psi		1000 Psi		1500 Psi	
	Major Area	Minor Area	Head End	Rod End	Push	Pull	Push	Pull	Push	Pull	Push	Pull
1	0.78	0.58	0.78	0.58	195	145	390	290	780	580	1170	870
1 9/16	1.91	1.47	1.91	1.47	477	368	955	735	1910	1470	2865	2205
2	3.14	2.54	3.14	2.54	785	635	1570	1270	3140	2540	4710	3810
2½	4.91	3.91	4.91	3.91	1228	978	2455	1955	4910	3910	7365	5865
3	7.06	5.84	7.06	5.84	1765	1460	3530	2920	7060	5840	10590	8760
3½	9.62	7.86	9.62	7.86	2405	1965	4810	3930	9620	7860	14430	11790
4	12.56	10.80	12.56	10.80	3140	2700	6280	5400	12560	10800	18840	16200
4½	15.90	13.50	15.90	13.50	3975	3375	7950	6750	15900	13500	23850	20250
5	19.63	16.49	19.63	16.49	4908	4123	9815	8245	19630	16490	29445	24735
6	28.27	24.30	28.27	24.30	7068	6075	14135	12150	28270	24300	42405	36450
7	38.48	33.58	38.48	33.58	9620	8395	19240	16790	38480	33580	57720	50370
8	50.26	43.20	50.26	43.20	12565	10800	25130	21600	50260	43200	75390	64800

Distinctively Designed...Easier Recognized ...Shows First Quality at First Glance

Simonds "Red Tangs"... *the files that cut instead of scrape,* because they have teeth like a Simonds metal-cutting saw... will soon come to you in these distinctive ALL-RED packages.

This modern dress is designed for "family resemblance" to other Simonds red-trademarked, red-packaged products... and for easier identification of the files that are made in first-quality only... the files that workers like because they cut faster with less "elbow-grease."

So watch for these new ALL-RED packages...and make it a point to specify Simonds "Red Tang" on your next file order.

SIMONDS
SAW AND STEEL CO.

FITCHBURG, MASS.

Branch Offices in Boston, Chicago, Los Angeles, San Francisco and Portland, Ore., Vancouver, B. C. Canadian Factory in Montreal, Que.

TALKING SHOP

White Collars

REQUIRED government reports and the "mechanizing" of industry are causing surprising changes in distribution of working personnel. A recent report indicates that 20 years ago there were 9 productive workers for each office worker; now there are 4. Productive workers are up 178% in 20 years, office workers 400%.

Box-Office Hit

DEMONSTRATORS operating production machines for one exhibitor at the recent ASTE Tool Show in Philadelphia actually earned more than their own way in finished parts produced during the week. Despite interruptions to answer questions for visitors, their output of customer's parts was sufficient to cover salary and personal travel expenses.

Fewer Severances

GENERAL MOTORS had 24,213 fewer employes who quit their jobs in 1949 than in the previous year. George A. Jacoby, of GM, lays it to better employe attitude, and better selection, placement and follow-up. This improvement was achieved in the face of increasing employment, when turnover percentage usually rises.

Too Good

A FEW YEARS AGO, a young fellow walked into the personnel office of a well-known machine-tool manufacturer, asking for a job. He was hired as a machinist. Soon afterward the rumblings were heard—his production rate was so far superior to the output of the others that they all complained. Union stewards asked the company to remove him as unfair competition. Instead, company officials investigated and found themselves with a master of tooling tricks. They set up a showroom to demonstrate their own equipment, put him in charge, and today he delights their customers with tooling methods that really sell machines.

Widgets

OFFICIAL RECOGNITION of the word "widget" is provided by Hanson-Van Winkle-Munning, which uses it to describe the company line of plating and polishing accessories. Included are aprons, gloves, brushes, glue, anode bags, leather, air-agitation piping, and so on—even to a plater's microscope.

Prompts us to suggest our pet word, "eruzamitch" (sp?), meaning anything sticky.

Out of the Mouths of Babes

DELCO PRODUCTS recently paid a stenographer a $1000 defense bond for her suggestion that solved a complex broaching problem. A typist in the tool-grinding department, she suggested that a series of holes be drilled around each finishing tooth in a solid broach to convey coolant in finish-broaching the inside of a shock-absorber cylinder. Her idea extended tool life, improved finish quality and cut scrap.

Delco Products paid out $4161 for suggestions in two months this year.

Metal to Wood

METALWORKING TRICKS applied to woodworking provide master joinery in minutes. A Detroit tool engineer recently applied his production know-how to some standard woodworking power tools. By standardizing the basic pieces and using jigs and fixtures, he has a few girls produce picture frames in eight different shapes—one every two minutes. Your shop may be tooled to the hilt, but how about your packing department or other woodworking operations?

Deutsches Maschinenbau

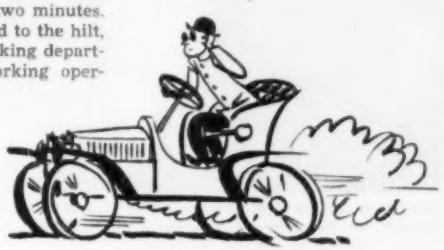
TWO GERMAN machine tools at the Hanover Fair attracted wide attention. One was a radial drill on which feeds and speeds for the next hole can be preset while the machine is operating, then attained simply by pressing a button. The other was a lathe with all feeds and speeds controllable from the apron.

Two Cuts

SAID A FIAT EXECUTIVE to J. A. Raterman, of Monarch Machine Tool, during the latter's visit to Italy: "Our plant was like any other early in the war. Then a 300-plane raid came over—like a roughing cut. Another 300-plane raid provided the finishing cut. Each took about five minutes." That's supersonic machining.

Shades of Stanley!

WE THOUGHT the Stanley steamer had permanently banked its fires until we ran into Erik Delling. He and Gilbert Stevenson, both leading lights in the old Stanley company, have developed a new steam-generating unit for cars, buses, and trucks. Operating on fuel oil, it starts at the turn of switch, and will get up steam in 2½ min. They claim the average motorist driving 20,000 miles a year would save $231 in operating expenses. The only controls are a throttle, brake, and reverse pedal. The cranking motor, clutch, and transmission are naturally eliminated. They visualize the principal applications as in trucks, buses, taxis, and small yachts. Selling price for a steam sports car in production runs of 25 or 30 would be $3500; with quantity production it would drop to $2000. In fact, as Delling tells it, they have everything they need but the capital.



• **STRESS AND STRAIN RECORDER,** a new type, which operates in conjunction with a Baldwin-Southwark 100,000-lb testing machine for tensile, compression, shear and bending strengths of materials, is in use at the Naval Engineering Experiment Station, Annapolis. A new-type microformer in the strain amplifying mechanism replaces the old micrometer and lever system which depended on the integrity of electrical contact.

• **INDUSTRIAL MACHINERY,** engines, hand tools, and measuring equipment from more than a dozen nations will be on display August 7-20 at the First United States International Trade Fair in Chicago. U. S. firms will occupy one-third of the space.

• **CHRYSLER CORP.** marked its 25th anniversary on June 6. Since that date in 1925, Chrysler has paid $3,598,000,000 in wages and salaries to its employees and over $447,000,000 in dividends. Other statistics released by the company: almost 14 million passenger cars and trucks made since 1925; yearly production of 1,200,000 vehicles in 1949 compared with 133,357 in 1925; 110,000 employees today, 10,000 in 1925; yearly dollar purchases from suppliers now more than $1,300,000,000, compared with $92,000,000 in 1925.

• **ELECTRICAL EQUIPMENT** totaling more than $1 million is being supplied to the Italian steel industry by Westinghouse Electric International Co., under an ECA program to modernize the industry and reduce import requirements.

Inflationary Factors to Push Prices Upward, Industrial Suppliers Hear

ATLANTIC CITY—The general level of prices will continue to increase in the foreseeable future, predicted Ralph J. Cordiner, General Electric Co. executive vice president, addressing the 1950 Industrial Supply Convention here May 22. Inflationary factors in the economy automatically point the way to higher prices, "short of a national or international calamity," he said.

"All about you are indications of a gradual creeping inflationary trend; higher wages . . . an unbalanced federal budget and thus deficit spending; and very high proportionate employment where approximately 93% of all the people in this country desiring to work are gainfully employed," he noted.

The more than 2500 members attending the conclave are members of three trade organizations—American Supply & Machinery Manufacturers Assn., National Supply & Machinery Distributors' Assn., and Southern Supply & Machinery Distributors Assn.

• **Better utilization of sales** personnel, more sales promotion and larger use of sales analysis figures were recommended for the nation's industrial supply industry by representatives of manufacturers and distributors. Teamwork between manufacturers and distributors in selling the industry's many products to the consumer was stressed in convention talks.

High optimism for the nation's industrial supply business was expressed, with a prediction that volume of business done by the industry in 1950 would approach the peak year of 1948 when volume reached approximately $3.5 billion.

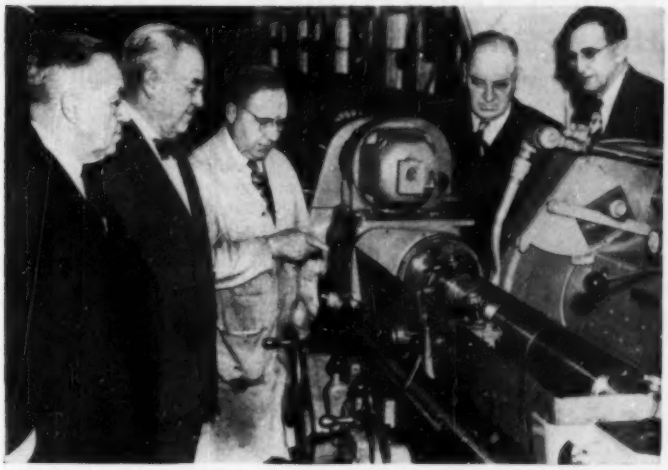
• **New officers were elected** by the three industrial supply groups. Franz Stone, president, Columbus McKinnon Chain Corp., Tonawanda, N. Y., was elected president of American Supply & Machinery Manufacturers Assn. Named with him were R. M. Johnson of Norton Co., Worcester, Mass., first vice president; J. A. Proven of Porter-Cable Machine Co., New York, second vice president, and C. F. Connor of B. F. Goodrich Co., Akron, treasurer.

J. H. Ruddell, president, Central Rubber & Supply Co., Indianapolis, was elected president of National Supply & Machinery Distributors Assn. Other officers named: Harold E. Torrell, Syracuse Supply Co., Syracuse, N. Y.; T. Gordon Vaughan, W. M. Pattison Supply Co., Cleveland; and W. A. Haseltine, J. E. Haseltine and Co., Portland, Ore., vice presidents.

Joe W. Pitts, president, Brown-Roberts Hardware & Supply Co., Ltd., Alexandria, Va., was elected president of Southern Supply & Machinery Distributors, along with W. L. Wellford, Jr. of J. E. Dilworth Co., Memphis, Tenn., first vice president, and B. S. Barker of Pye-Barker Supply Co., Atlanta, second vice president.

RALPH J. CORDINER, executive vice president, General Electric Co., was principal speaker at the 1950 Industrial Supply Convention, May 22, at Atlantic City

NEW PRESIDENTS of the three industrial supply associations are, left to right, Joe W. Pitts, Southern Supply & Machinery Distributors; Franz T. Stone, American Supply & Machinery Manufacturers; and J. H. Ruddell, National Supply & Machinery Distributors



EARLY ASSOCIATES of C. H. Norton in development of cylindrical grinding at Norton Co. look over today's Type CTU cylindrical grinding machine, modern counterpart of the first Norton grinder. Left to right, Herbert J. Griffing, manager, labeler section; Frank W. Smith, vice president and manager, Grinding Machine Div.; John Cook, foreman, Dept. No. 8; Albert G. Belden, manager, research and engineering; and Iver G. Freeman, factory manager. All are still active in the Grinding Machine Division

Norton Grinding Machine Division Celebrates 50th Anniversary

WORCESTER, Mass. — This year marks the 50th anniversary of Norton Company's Grinding Machine Division.

Upon incorporation 50 years ago as Norton Grinding Co. (an independent enterprise whose parent was the then Norton Emery Wheel Co.) work began on "Norton Plain Machines for Cylindrical Grinding." The first production-precision cylindrical grinding machine made in the United States was sold to R. H. Hoe & Co., New York, for grinding printing press rolls. This machine was in continuous operation for 27 years, after which Norton Co. repurchased and presented it to the Edison Institute of Technology at Dearborn, Mich., where it has been on exhibit ever since.

• **The Norton Emery Wheel Co.** name was changed to Norton Company in 1906 when manufactured abrasives replaced natural emery and corundum in manufacture of grinding wheels. The name Norton Grinding Co., however, remained as such until 1919, when it was merged with Norton Co., becoming the Grinding Machine Division as it is now known.

Norton Grinding Co. founders realized mutual benefits derived from making the machines that used the parent company's wheels, and Norton Co. was the first concern in its field to make them both.

The most important factor in the decision to manufacture grinding machinery was Charles H. Norton (no relation of Franklin B. Norton of grinding wheel and pottery fame). Mr. Norton was a machine designer with Brown & Sharpe Co. of Providence, R. I., who came to the old Norton Emery Wheel Co. with plans for the first production cylindrical grinding machine.

He and his associates were responsible for many developments pioneered by Norton Grinding Co. early in the century: crankshaft and camshaft grinders, roll grinders, flat surface grinding machines, fully automatic cylindrical grinding machines, and machines for lapping, to name a few. In all, over 41,000 grinding machines have been turned out by the company since 1900.

Highlights of American Iron & Steel Institute Meeting May 24-25, New York

• **Effective materials handling** practices have contributed much to record steel production of past decade, according to W. G. Nichol and W. N. Flanagan of Carnegie-Illinois Steel Corp. George Todd of Armco Steel cited an example of economies realized: By handling refractory brick on pallets, rather than loose, average open hearth shop can save up to $35,000 in course of a year.

• **Analysis of steel** by means of spectograph in place of wet chemical methods saves time so effectively that electric furnace production can be speeded up to as much as nearly four heats a day, where three had been customary, said E. O. Waltz of Republic Steel's Canton Steel Div.

• **Grain structure of steel** can be magnified as high as 100,000 diameters with electron microscope, compared with 2,000 diameters with light microscope, according to Alfred L. Ellis of International Harvester Co., making it possible to discover more about relationship between particle size in steel and strength and ductility characteristics.

• **Use of electronics** for main and auxiliary steel mill drives, far from being "fascinating gadgetry," result in higher tonnage output, improved quality or lower operating cost, said W. R. Harris of Westinghouse Electric Corp. L. A. Umansky of General Electric revealed that increasing numbers of electronic tubes, or tanks, are being used instead of bulky motor-generators to convert purchased alternating current to the direct current rolling mills require.

• **There's no shortage of iron ore,** declared C. C. Henning and R. W. Braund of Jones & Laughlin. Rather, the choice before steel companies is just which reserves to develop. "Several operating procedures have been altered with end result that large quantities of hitherto unacceptable raw materials have been placed in the desirable classification."

• **AUSTRALIA'S** budding automobile industry remains a major investment target for American and British concerns. With American firms this means reinvesting profits earned on old-established branch plants, in order to avoid a transfer tax in Australia and a profits tax in U. S. Ford Motor Co. of Australia has gone three quarters of the way to building a 100% Australian car. Only key components are produced in Ford's own plants. About 300 subcontractors are supplying 5000 different parts for processing or ready for assembly. Britain's Rootes Group now assembles 10,000 vehicles annually and within a few weeks the rival Nuffield organization will swing into production for the first time. English-made chassis components will be assembled.

• **CZECHOSLOVAKIA** and Brazil have signed a barter-type trade agreement calling for shipments of roughly $15 billion by each country. Brazil will supply the Czechs with $12 million in raw materials, $2.2 million in food products, plus $110,000 in manufactures and small items, and receive from abroad $12.7 million in capital goods and vehicles, $1.6 million in raw materials, $1 million in food products and $460,000 in miscellaneous items. A similar agreement involving $16 million in shipments also has been signed by Brazil and Austria.

WALTER GUY ROBBINS, president of Carboloy Co., Inc., Detroit, whose death May 18 at 49 years of age was noted briefly in *AM* May 29. He joined Carboloy, a General Electric subsidiary, as district manager in 1929. In 1930 he was made general manager and then vice president, and in 1936 was elected president. He was one of the founders and later president and chairman of Cutting Tool Manufacturers' Assn., was a member of ASTE and ASME. He was a director of Allied Products Co. Detroit.

European Auto Producers Sell to Brazil Under Stimulus of Barter Import Deals

RIO DE JANEIRO (McGraw-Hill World News)—Stimulated by Brazilian insistence on barter-type import deals, European auto producers are moving into Brazil on a large scale.

Italy's Alfa Romeo has succeeded bankrupt Isotta Fraschini in its supply and co-operation deal with Brazil's National Motor Factory. The deal appears to involve the shipment from Italy of $7 million worth of trucks and truck components. The original Isotta deal was for $12 million of which only a small part was filled.

• **A new trade agreement** with Italy is due to open the door for the establishment of a Fiat assembly plant. Fiat, moving ahead on its own, also has a contract for the supply of 1000 farm tractors in exchange for cocoa of equivalent value. Ford of Great Britain also is active. A new assembly plant at Sao Paulo is beginning the production of Prefect and Anglia passenger cars and Thames trucks. More than 1500 units had been shipped in the first few months of this year, compared with 2090 in all 1949.

As in the Fiat tractor deal, Ford's imports are "compensated" this time by exports of Brazilian sawn lumber. This follows the new regulation, affecting established assemblers primarily, that applications for passenger car imports may only equal the unit quota for the same period in 1949, must not be for cars whose f.o.b. price is more than the equivalent of U.S. $1800, and must be covered by proved exports or commitments for export of either caroa fiber or timber.

At present there is no ceiling on truck imports, but licenses are granted only to assemblers or authorized dealers, and the "compensation" export must be in the form of bananas, tobacco, oranges, caroa, mate (Brazilian tea) or timber.

Demonstrating how a brand name becomes common usage, the regulation on Jeeps follows that for trucks, but states that they may be imported from any place except the U.S.A. (where Jeeps are made). The only approximate equivalent vehicle, of course, is the British "Land Rover" which is appearing in greater numbers steadily.

Revitalized Germany is also contributing to Brazil's motor fleet. Mercedes-Benz's Brazilian distributor recently took delivery of over 800 trucks, 50 passenger cars and 12 buses. It announced that it too would like to assemble in Brazil, perhaps with motors made under license by the National Motor Factory. It added that the uncertain conditions in Germany had caused Mercedes-Benz headquarters to study the possibility of moving the whole works, employing 20,000 skilled employes, to Brazil.

British Machinery Dominates Canadian Trade Fair at Toronto

TORONTO — British industrialists weren't fooling last fall when they said they were going all out for increased business from American and Canadian markets (*AM* Nov. 17, p. 126). British exhibits at the third Canadian International Trade Fair here May 29-June 9 heavily dominated the Fair's largest classification —the machinery, engineering and plant equipment exhibit.

Fully three-fourths of the floor space in the Automotive Bldg., which housed industrial and machinery exhibits, was occupied by British firms. The British Tool, Machine Tool and Scientific Instrument Sections alone (representing nearly 100 firms) occupied more than half of the total area of 66,864 sq ft taken by Great Britain at the Fair.

United States firms took only 3000 sq ft of space, but of course many others were represented through their Canadian subsidiaries.

Canada, with 41,740 sq ft floor space, was second largest exhibitor, followed by Czechoslovakia with 12,240, Italy with 6,480, and France with 3,480. In all thirty nations exhibited their products at the Fair.

A more detailed report of the Fair will be presented in the next issue of AMERICAN MACHINIST.

Gear Manufacturers Elect New Officers at 34th Annual Meeting

LeRoy Brooks, Jr.

George H. McBride

Louis B. Bond

J. Harper Jackson

HOT SPRINGS, VA. — New officers and executive committee members of the American Gear Manufacturers Assn. were elected at the 34th annual meeting here at the Homestead, June 5-7.

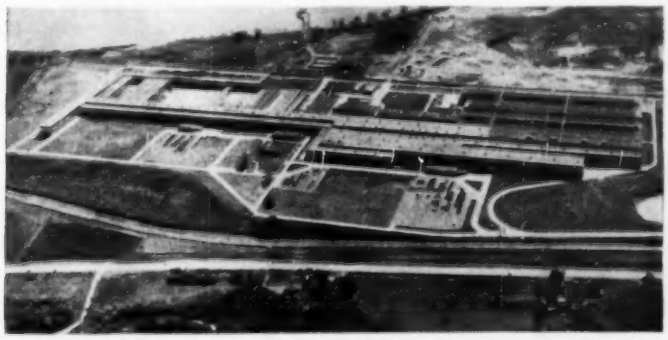
LeRoy Brooks, Jr., president of Tool Steel Gear & Pinion Co., Cincinnati, was elected president; George H. McBride, sales manager of the Nuttal Works, Westinghouse Electric Corp., Pittsburgh, was elected vice president; and Louis B. Bond, vice president and general manager of Christiana Machine Co., a subsidiary of Charles Bond Co., Philadelphia, was elected treasurer of AGMA.

New executive committee members: J. Harper Jackson, sales manager, Jackson Gear Co., Pittsburgh; J. R. Mahan, director of engineering, National Supply Co., Toledo; Fred R. Eberhardt, president, Eberhardt-Denver Co., Denver, Colo.; and Walter W. Trout, president, Lufkin Foundry & Machine Co., Lufkin, Tex.

J. R. Mahan

Fred R. Eberhardt

Walter W. Trout



WORLD'S LARGEST aluminum sheet and plate rolling mill, capable of producing sheet and plate products up to 120-in. wide from 7000-lb ingots, was opened May 16 by Aluminum Company of America at Davenport, Iowa. Plant has almost 2¼ million sq ft under roof. Some 30,000 tons of industrial machinery are installed. First rolling operations are performed in 144-in. four-high hot mill equipped with edging rolls. Here ingot first is rolled broadside until proper width is obtained, then lengthwise to proper slab thickness. Rolled slabs then are moved by power roller conveyor to reheating furnaces or directly to succeeding operations. End shearing is performed with up-and-down cut type guillotine shear capable of cutting slabs 6½-in. thick. Continuous hot rolling of sheet and strip stock is done in modern 100-in. wide, five-stand, four-high tandem mill in which all stands are individually motor-driven. This mill is followed by a rotary slitter for cutting strip to width, and high-speed coiling equipment which prepares coils for annealing furnaces. The Davenport Works also is equipped to produce plate products up to about 3½-in. thick and 100-in. wide

MEETINGS

June 12-16—American Electroplaters' Society, international conference on electrodeposition; Hotel Statler, Boston.

June 12-16—American Institute of Electrical Engineers, summer and Pacific general meeting; Huntington Hotel, Pasadena, Calif.

June 15-17—Material Handling Institute, meeting; Greenbrier Hotel, White Sulphur Springs, W. Va.

June 19-23—American Society of Mechanical Engineers, semiannual meeting; Hotel Statler, St. Louis.

June 22-23—Malleable Founders' Society, annual meeting; The Homestead, Hot Springs, Va.

June 26-30—American Society for Testing Materials, annual meeting and exhibit; Chalfonte-Haddon Hall, Atlantic City, N. J.

Aug. 7-19—First U. S. International Trade Fair; Coliseum, International Amphitheater and Navy Pier, Chicago.

Aug. 14-16—Society of Automotive Engineers, West Coast meeting; Biltmore Hotel, Los Angeles.

Sept. 12-14—Society of Automotive Engineers, tractor meeting; Hotel Schroeder, Milwaukee.

Sept. 18-22—Instrument Society of America, instrument conference and exhibit; Buffalo Auditorium, Buffalo, N. Y.

Sept. 19-21—American Society of Mechanical Engineers, fall meeting; Hotel Sheraton, Worcester, Mass.

Sept. 23-26—Packaging Machinery Manufacturers Institute, annual meeting; Homestead, Hot Springs, Va.

Sept. 26-29—Association of Iron & Steel Engineers, annual convention and bi-annual exposition; Cleveland Public Auditorium.

Sept. 27-30—Society of Automotive Engineers, aeronautic meeting and aircraft engineering display, Los Angeles.

New Tooling

Good news comes from machine tool builders. Upswing in orders which began last November has finally carried into almost all lines and into standard as well as special types of machines.

Division of business among companies is much more evenly spread than it was. Backlogs are bigger, however, among the "specials," some of whom have their full capacity taken up through next February.

It's the same old story, so far as sources of orders are concerned. The automobile industry leads by a wide margin. And much of the new equipment will go into plants outside Detroit area.

• • •

Press builders are even busier, on the average, than machine tool companies. Some are sold out for the year. Others hope to be in that enviable spot soon. Automotive industry is sparking good share of press orders. Terrific pressure for early deliveries is reported.

• • •

"Equip your shop with new machines as a good hedge against inflation, which appears to be on the way." That is a new potent sales argument being used by machine tool salesmen. Some distributors who have tried it say it works fine.

• • •

Invasion of U. S. machine tool market by foreign builders, especially British, is causing much discussion. Alfred Herbert, Ltd. is one company which has ambitious plans for selling its line of machines in this country. Its standard machines are tagged at about one-half the price of similar U. S. machines.

Equipment builders' eyes are on the current Canadian International Fair, which on the machine tool side is dominated by British. Canadian builders are unhappy about British determination to sell more machines in Canada, hope to restrict such sales by government edict forbidding import into Canada of types of machines made in Canada.

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Washington is trying to put stop to export of British machine tools and presses to Soviet Russia and her satellites. U. S. builders have long been forbidden export permits for shipments to those countries. Last year Britain sent large number of machines, majority of them used units, to eastern Europe.

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Kaiser-Fraser is about ready to start buying equipment for a new 6-cylinder valve-in-head engine for 1952 models. A V-8 is planned, also.

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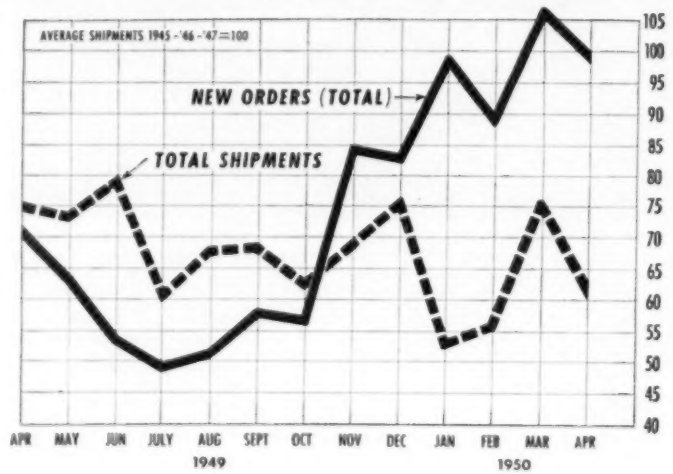
Why doesn't Equitable Life buy and then lease machine tools to metalworking companies, just as it is buying and leasing freight cars to railroads? That question has popped up lately.

There is a precedent for such action. During World War II the government ordered thousands of machine tools and leased them to private contractors on a rental basis.

April New Orders for Machine Tools Stay Up Near Record High Level

	New Orders (Total)	Foreign Orders (Included in Total)	Shipments (Total)
1948			
Jan.	83.1	14.0	75.3
Feb.	77.3	12.7	87.1
Mar.	86.3	16.1	83.6
Apr.	86.3	14.1	82.0
May	73.5	11.4	82.6
June	83.4	11.9	94.4
July	74.0	13.3	62.4
Aug.	73.7	13.6	69.8
Sept.	73.1	11.6	84.7
Oct.	67.4	14.0	80.4
Nov.	72.2	18.1	76.2
Dec.	76.7	16.2	96.9
1949			
Jan.	87.0	21.9	68.8
Feb.	80.9	26.5	70.3
Mar.	93.5	22.3	75.8
Apr.	70.1	23.1	74.7
May	63.7	15.8	72.8
June	53.6	15.7	79.0
July	48.0	14.0	60.7
Aug.	51.5	18.8	67.3
Sept.	57.7	13.7	67.6
Oct.	56.8	13.7	62.3
Nov.	84.3	17.0	67.6
Dec.	82.5	22.4	75.7
1950			
Jan.	99.7	26.7	52.8
Feb.	89.2	18.8	56.1
Mar.	107.4	24.9	75.3
Apr.	p 99.2	p 17.6	p 61.7

Data: NMTBA p — Preliminary figures



Detroit

Cheerful notes for machine tool and equipment companies from the stockholder meeting remarks of Alfred P. Sloan, Jr. of General Motors Corp: Forward capital expenditures including model change tooling will approximately equal, during the next two years, what was spent in the last two years. Needed is more capacity for electric refrigerators, for high compression engines, for diesel engines, for locomotive manufacturing and for stamping. The Technical Center, which is being built now, will eventually entail expenditure of about $50-million.

But don't expect tooling on a small car. "Today we cannot seem to justify it; we have no plans for production. But again, conditions change. Today is today. Tomorrow is tomorrow."

• • •

Manufacturing rates are monstrous. The last full week in May saw built 183,670 cars and trucks in U. S. and Canadian plants. That's more than 10,000 ahead of any other week in automobile history. June may see even higher totals—Chrysler is not yet at peak following its strike. Despite this, sales are holding their pace. The most commonly used words in the factory delivery reports these days are "all-time record."

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Automotive Tool & Die Manufacturers Assn. at Detroit has made history of its own on pensions. Most of its member shops—about 70 in all—have signed an area-wide pension agreement with the auto union. A worker can transfer from one plant to another and retain his pension credits, deposited in the association. About 4,000 men are involved.

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Word from Chrysler Corp. innermost sanctums is that the top brass of the company realizes what many observers and competitors had insisted all along—that the lines of their 1950 automobiles are a little too straight-laced for public taste today. Accordingly, work is going on apace to make over the body lines.

New styling concepts are being planned through all four nameplates — lower roofs, longer rear fenders, changed sloping on rear quarter panels, revised sides, and others. Much of this die work is already placed and in progress; a good share of it is reportedly being done at Briggs, stamping source for Chrysler.

In addition, the engineering department at Highland Park is hard at work on a torque converter program. Although Chrysler has stoutly stood by its semiautomatic fluid coupling, it now seems to be going along with the generally accepted approach that a torque converter is the basis of future automatic transmissions.

More details are also gradually coming to light on the new General Motors automatic transmission. This job, third in the series pioneered by General Motors, is—as was anticipated earlier—a torque converter in the lower speed stages, locked up by planetary gears at cruising speeds. The new transmission is destined for initial use in Cadillac models.

The General Motors Hydra-Matic, meanwhile, is expected to make an appearance before long on the Hudson line. Hudson, like Kaiser-Frazer, Lincoln, Mercury and Nash, has arranged to use the Hydra-Matic on a royalty basis; modifications are now being completed toward this end at the Detroit transmission division.

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Pontiac is building a new motor engineering center—a two-story structure of 213,000 sq. ft. of working space. Included in addition to offices, laboratories, and other requirements are a machine shop, sheet metal shop, paint and wood-working shop, dynamometer room and others. Objective: To build any kind of engine for experimentation, and to test it fully.

FOUR GREENLEE AUTOMATIC TRANSFER MACHINES for machining Ford transmission cases were demonstrated at Greenlee Bros. & Co. plant, Rockford, Ill., May 24. Here, left to right, are M. L. Katke, plant manager, Cincinnati transmission plant and John Dykstra, general manager, outlying operations, Ford Motor Co.; and R. O. Knudson, machine tool sales, Greenlee Bros. The four machines have total length of 145 ft, use 183 tools to perform 208 operations at 41 work stations. Total of 45 heads perform these 208 operations. Power is supplied by 79 electric motors with total rating of 306 hp. The four machines can be operated individually, but the first two can be controlled from a single station if desired

Washington

More industry say in maritime matters is one thing you can count on now that Maritime Commission has been reorganized under Commerce. Secretary Sawyer plans a joint government-industry committee to advise him in decisions affecting shipping. Ship builders, operators, and suppliers will be represented on the committee.

Another good thing about reorganization: It paves the way for a thorough house-cleaning of the Commission's over-abundance of stuffy bureaucrats.

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New design for projectiles may result from Army's latest camera with a top possible framing rate of 10-billion "shots" a second. Using 100-million frames a second, explosives researchers are able to "freeze" 18,000 mph shock waves on color film. Morton Sultanoff is the designer.

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Fine-tooth examination of 1949 tax returns for business with assets of $250,000 or less is latest Bureau of Internal Revenue project. BIR is after loopholes, value of revenue lost, most frequent errors, and simpler forms. BIR will sample 160,000 returns including income, social security, withholding, and retail excise taxes.

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New House Labor Committee chairman, Rep. Barden (N. C.), favors a labor law even tougher than Taft-Hartley. He replaces Rep. Lesinski who died suddenly last month. It kills any slim chance labor might have had of getting bills favorable to labor through the committee this year.

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General Motors' five-year labor contract reflects labor and business' faith in the stability of the current economic pattern. A BLS check shows almost 5% of the labor contracts signed in the last six months were for three years. Before the figure was about one-half of one percent.

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Tax evaders who confess voluntarily before Treasury agents start hounding them may be immune from criminal prosecution. It's in the House version of the 1950 tax bill.

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Washington isn't frightened by predictions of short supplies and high prices in building materials. Experts figure current shortages are temporary; that supplies will keep pace easily with demand after a short lag; that prices won't come near earlier postwar highs.

Housing starts, however, will hit an all-time high this year, with the total expected to reach 1,500,000, against last year's 1,025,000 record.

AFL Union of Technical Engineers, Architects, and Draftsmen is plugging two bills to bring their members under the Walsh-Healy Act covering wage rates for work on government contracts. The union fears an over-supply of engineers may mean lower salaries for its members.

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There's early promise the newly reorganized FTC may make more sense. Recent FTC internal order told its employees they "will determine by accomplishment the permanency of their appointment."

Steel industry officials aren't optimistic, however. Their comment: "The more it (FTC) changes, the more it is the same."

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Look for a dollar loan — Around $30-million — before long to Mexico's state oil industry, Pemex. Export-Import Bank will furnish the money to be used in buying U. S. transportation, refinery, and storage equipment.

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ITO is out, for this year anyhow. Mr. Truman's for it, but Congressmen don't even want to vote on it until after elections. If Mr. Truman forces a decision this year, they'll probably kill it.

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Union pressure for a 30-to-35 hour week doesn't have Labor Secretary Tobin's support. He thinks it's too soon, would cut production and depress living standards. Unions think it would mean job stabilization.

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Navy's newest high altitude test chamber permits laboratory observation of full scale ram-jet engines at speeds up to mach No. 4. The chamber, a 10-ft by 125-ft steel cylinder with a 30-ft door, is located at Ordnance Aerophysics Laboratory, Daingerfield, Texas.

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Still no action on extending copper tariff exemption. House Ways and Means Committee plans hearings after it approves tax bill later this month. Government and industry (except mining) both want copper's tariff-free status continued. Rising prices may lessen miners' opposition.

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The $250-million Export-Import Bank guarantee bill to back up private investments in point-4 projects stands a good chance of being passed. It would let Ex-Im Bank guarantee U. S. investments abroad against non-business risks (except war risk) such as expropriation.

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Delay in getting 1951 appropriations voted will push back government contracting. That means buyer and seller alike will be effected.

Elmer F. Twyman

Carl. F. Schnuck

Alfred J. LeBrun

Robert W. Kerr

Names in the News

Elmer F. Twyman has been elected vice president in charge of the Philadelphia Div., Yale & Towne Mfg. Co., New York, to succeed **James C. Morgan** on his retirement June 15. Mr. Twyman for 15 years was general manager of Automatic Transportation Co. Div. of Yale & Towne, in Chicago. He is a past president of Electric Industrial Truck Assn. **John A. Baldinger,** assistant general manager of Automatic Transportation Co. Div., will join Mr. Twyman as assistant general manager at the Philadelphia plant.

Charles Edison has been elected chairman of Thomas A. Edison, Inc., West Orange, N. J., and **Henry G. Riter, 3rd,** was elected to succeed Mr. Edison as president. Mr. Riter has been a director since 1946, and chairman of the executive committee since January, 1949. He is also senior partner of Riter & Co., New York, and chairman of Copperweld Steel Co., Pittsburgh.

H. O. Holland has been elected vice president in charge of sales of all divisions of Automatic Steel Products, Inc., Canton, Ohio. He has been director of sales since 1947, and was formerly vice president, Kellog Div., American Brake Shoe Co. **John E. Carnahan** has been named vice president, Spun Steel Div. of Automatic.

E. W. Donkel has been elected president, Kent-Owens Machine Co., Toledo, succeeding his father who died March 3. After a year with Warner & Swasey, he joined Kent-Owens in 1937, and has served as vice president and general manager for the past six years. Added to the company's directorate was **Walter C. Strehlau,** who was also elected assistant secretary.

Carl F. Schnuck has been named director of engineering and **Warren C. Whittum,** chief engineer, of Farrel-Birmingham Co., Inc., Ansonia, Conn. Mr. Schnuck joined the firm in 1899. In 1945 he was named chief engineer and elected to the board of directors. Mr. Whittum joined F-B in 1930.

Alfred J. LeBrun has been named Connecticut sales engineering representative, Lucas Div., New Britain Machine, Co., New Britain, Conn. He will handle all sales and service for Lucas horizontal boring, drilling and milling machines.

Anthony J. Potts has been named Chicago district manager, Selas Corp. of America, Philadelphia.

A. F. Boucher has been named Detroit district manager, Lincoln Electric Co., Cleveland. **I. R. Bartter** has been transferred from Grand Rapids to Milwaukee as district manager, succeeding Mr. Boucher there. The following have been added to the welding engineering staff of district offices: **J. W. Brooks,** Boston; **J. J. Chemerys,** Syracuse; **W. R. Karll,** Newark, N. J.; **R. G. Todd,** Tulsa, Okla.

W. O. Lippman and **Tom Turner,** both vice presidents of Westinghouse Electric Corp., Pittsburgh, have exchanged positions. Mr. Lippman, formerly in charge of plant labor relations, becomes head of the Westinghouse Elevator Div., Jersey City, N. J. Mr. Turner leaves the Elevator Div. to take charge of plant labor relations with headquarters in Pittsburgh. **B. M. Brown** has been named manager of special accounts. Since 1948 he has been assistant manager of Westinghouse Transportation, Marine & Aviation Sales Dept.

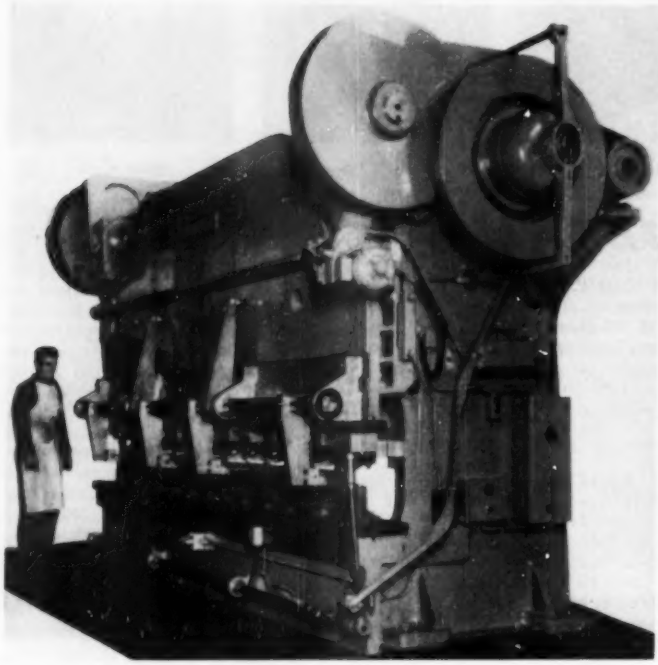
Robert W. Kerr has been elected president and chief executive officer, Bingham-Herbrand Corp. of Fremont and Toledo, Ohio. He joined the firm in 1948 as vice president and general manager of the Herbrand Div. Prior to that he was executive vice president, Plomb Tool Co. **Edward E. Parsons, Jr.,** was elected chairman. **David R. Femmster,** vice president, has been made general manager of Bingham Stamping Div. in Toledo. **Louis E. Yunker,** retiring president, will continue on the board. **Roland J. Ahern,** president of Billings & Spencer Co., Hartford, Conn., a subsidiary of Bingham-Herbrand, has been elected to the board.

Walter Bonsack has been named vice president and director of research, Christiansen Corp., Chicago.

Elwood E. Folsom, Jr., has been named manager, Trenton Works of General Electric Co.'s home laundry equipment division. **Clifford A. Flower** has been named manager of G-E's Brockport Works (heating device division), succeeding **M. P. Painter** who has been transferred to the household refrigerator division in Erie, Pa. In the G-E Chemical Dept., **Frank Gimblette,** manager of the Taunton, Mass., plant since 1947, has been named to the Plastics Division's manufacturing headquarters staff. **Thomas H. Way,** who succeeds Mr. Gimblette at Taunton, was until recently in charge of production engineering for Murray Body Corp., Detroit. **Nicholas Kondur** has been named manager of mold manufacture, Plastics Div. He was formerly assistant to the president of Douglas Tool Co., Detroit, and previously he was plant manager for Valor Tool & Machine Co., Dearborn, Mich.

Frank J. Blodgett has been named sales manager, Hard Surfacing Div., Alloy Rods Co., York, Pa.

New Shop Equipment



Multiple-Punching Setup Added to All-Steel Press Brake

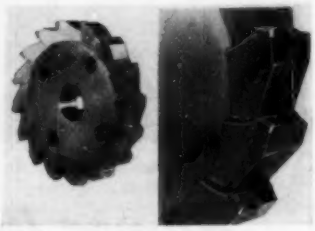
A special multiple-punching setup that eliminates the necessity of layouts and replaces the single-punch operation is said to result in great saving in punching time on support angle, support channels, side angles, and similar pieces. Holes originally had to be laid out by hand with a templet and then punches one at a time. Now the press brake is set up, the L-angles and channels are placed in the machine, and all holes in a side are punched at one time.

Punching equipment includes two sets of interchangeable punching blocks and covers the entire range of channels and angles. This includes structural channels from 3 in., 4.1 lb to 8 in., 11.5 lb, and structural angles to 5 x 5 x ⅜ in. Maximum hole diameter is 1 3/16 in. and equipment is arranged to punch either leg of the angles and both the web and flange of channels. Punches are provided with fixed strippers. The equipment is arranged to punch either leg of the angle and both the web and the flange of channels.

Equipment shown in front of the machine is a special pneumatic clamping device. Two air cylinders are attached to the ram of the press brake, and with the machine at the top of the stroke, the clamp is in the "out" position. As the ram moves down, the air pistons rotate the clamp which automatically holds work angle to the punching blocks.

Punching bolsters are kept in alignment by two leader-pin sets, so that equipment can be quickly placed into the press brake or removed to make it available for regular bending and forming work.

The Cincinnati Shaper Co., Hopple, Garrard & Elam St., Cincinnati, Ohio



Carbide-Tipped Face Mill Is for High-Power Millers

Carbide-tipped face mill incorporates new angles that are a modification of the Nelco Tri-Helix grind. The tool has nickel shims, sandwich brazing, and alloy-steel bodies. It is reported to remove 125 cu. in. of metal per min, consuming only 60 hp. In tests a ½-in. depth of cut, 10 in. wide was milled in cast steel at 25 in. per min table feed. Ruggedness of this tool and its unique design make these mills particularly useful for milling steel on high-powered milling machines. Sizes from 6- through 14-in. dia are available.

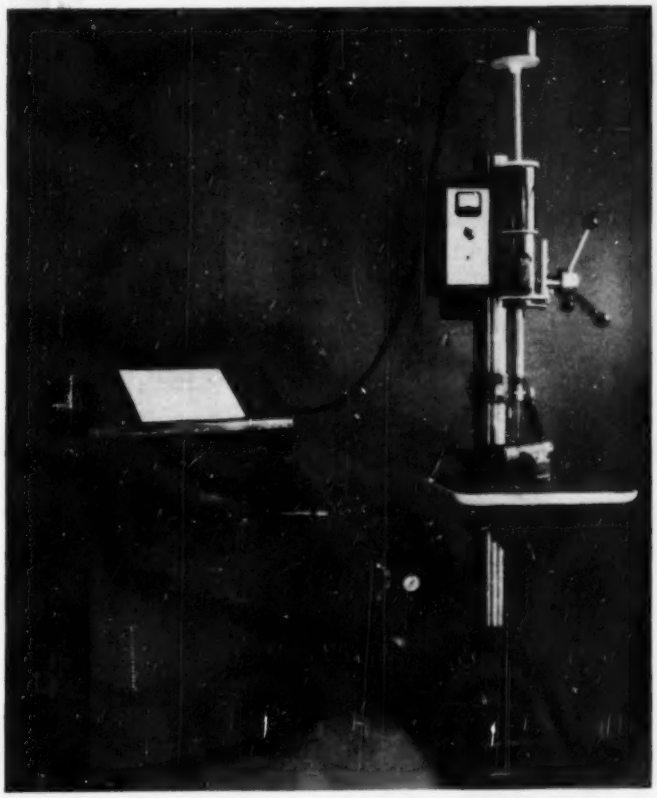
Nelco Tool Co., Inc., Manchester, Connecticut.

Toolholder and Followrest Combined in One Unit

Combination toolholder and followrest virtually eliminates the necessity of using steady rests or bulky machine followers in turning long small-dia work on lathes. Body of the holder is made of a high-grade steel forging measuring ⅝x1⅜x6¾ in., and accommodates a standard 5/16-in. square toolbit. It will take work up to 1½-in. dia and larger by adjusting the span of the hardened-steel rollers. The head of the holder is completely adjustable, swinging up or down, in or out.

Dasso Tool Products, Box 13, Lincoln Park, Mich.

Materials and Parts



Electronic Drill Speeds Cutting, Reduces Power Requirement

Motor-driven automatic hard-metal drilling machine employs an electronic principle of operation and is reported to increase speeds of cutting hardened steels as much as 15 times that of previous Elox models. Power required is cut to one-fifth.

The Electron Drill was originally designed for production cutting of a wide range of holes in metals and for production removal of taps, drills, and reamers, in a wide variety of sizes. On production drilling, performance can be duplicated exactly on each piece in regard to speed of cutting and type of hole required. Drilling is a continuous process for the full length of electrode used. The drilling can be either automatic or hand fed and the tool will chuck up to 36 in. of electrode.

Operating from any 110-v, 60-c lighting system, the Elox Electron Drill has a nominal 2-kva rating. Using a ⅛-in. optimum-size electrode, drilling time for ¼-in. hole is 25 sec., for ½-in. hole, 60 sec., and for 1-in. hole, 140 sec. Carboloy, nickel and cobalt steels, nickel and chrome steels, manganese steels, stellite, cast iron, copper and copper alloys, aluminum, Alnico, lead, and zinc are among the metals drilled by this unit.

Elox Corp. of Mich., 740 N. Rochester Rd., Clawson, Mich.

...INCLUDING

Large-capacity lathe for heavy multiple-tool turning provides versatility and ease of change-over .....page 144

Press brake brings the advantages of hydraulic operation to heavy plate work.....page 145

Copper-brazed cams, made of stamped-steel laminations, are approximately as strong as solid-steel cams.....page 146

Five-ton hydraulic press is built in both floor and bench models. Relief valve prevents overloading .....page 148

Six-spindle drilling and tapping machine is equipped with automatic indexing turret ... page 150

Combination worktable and quench tank attaches to induction heating units. Heating cycles are controlled by push-button .....page 152

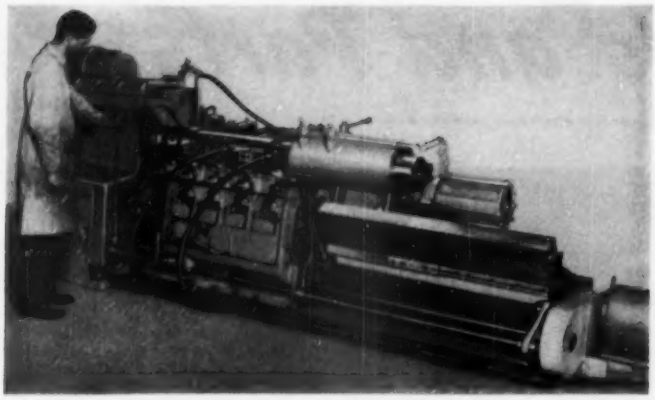
Pantograph system provides for fast hole location on high-speed turret punch press.....page 160

...and in June 26

Hand-feed bed turret can be fitted to the inside ways of 16-in.-swing lathe. The accessory is for economical production of duplicate precision parts.

Lead-extrusion press, oil-hydraulically operated, is designed for 7000-psi continuous duty. Push-button automatic cycling or manual control are available.

Hydraulic raising device is built into 84 x 96-in. revolving table. The table is graduated in ½" and can handle up to 90-ton loads.



Large-Capacity Lathe for Heavy Multiple-Tool Turning

A development of a specialized lathe used during the war for turning large gun tubes and high explosive shells, the model "LS" Lo-swing lathe has many of the structural features of the original model but is reported to provide greater versatility and ease of change-over. The front turning carriage may be equipped with two or more individually controlled, power-operated cross-slides which feed the tools into the cut. Tool cutting pressures are taken on large rolls, fitted to the bottom of each slide which remains in constant contact with the cross-feed control cam.

The cam-feed back-squaring attachment operates on an automatic cycle with push-button control. An adjustable stop positions the carriage in relation to the starting point of the cut and automatic tool relief is provided at the end of the cut. Model "LS" Lo-swing is said to be designed to take full advantage of modern sintered-carbide tools with very high cutting capacity at high cutting speeds and coarse feeds.

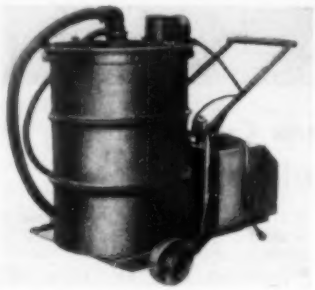
The Seneca Falls Machine Co., Seneca Falls, N. Y.

Tube Benders Eliminate Stock Run-Through

Gear-operated tube benders form copper, brass, aluminum, steel, and thin-wall tubing in either individual sizes or in combination sizes. Full 180° bends and positioning at any point on the tubing without disassembly are claimed as advantages.

OD sizes handled are ½, ⅝, ¾, ⅞, and 1⅛ in. Nominal tube sizes are ⅜, ½, ⅝, ¾, and 1 in. Because the benders are open-sided they can be slipped over tubing at any exact point desired. Benders may be hand held or clamped in a vise. Extension handles for tube sizes over ¾-in. OD are provided.

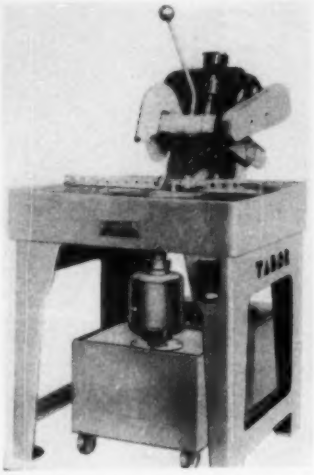
The Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago, Ill.



Mobile Oil-Dispensing Unit Operated by Single Switch

The Houdaille oil-dispensing unit is recommended for such plant applications as servicing hydraulic machines with new oil, removing dirty oil from hydraulic supply tanks, servicing machine tools with clean coolant, servicing quench oil in heat-treating machines, and transferring lube oil from drums to engine crankcases or gearboxes. The fully inclosed vacuum pump and 1/3-hp motor are operated by a single switch. A 3-way valve permits prompt changeover from vacuum to pressure side of the pump as needed, and no liquid or abrasives pass through the pump to cause wear or stoppage. The pivoting platform is designed for easy loading and unloading of standard 55-gal. oil drums.

Honan-Crane Corp., 701 Indianapolis Ave., Lebanon, Ind.



3-Hp Abrasive Cutoffs Added to Tabor Line

Available in floor or bench models, the 3-hp abrasive-cutoff machines handle right-angle to 45° bevel cuts, wet or dry operation. Capacity is ¾-in. solids, 2 in. x 16-gage or 1½-in. x 3/16-in. tubes, and formed light sheet up to 2 x 6 in. or equivalent areas. All units have Timken roller-bearing-mounted spindle and trunnion.

The Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.

Strong Grip, Easy Release Combined in Electrode Holder

The advantages of both tong and hole holders are combined in the LJ-1 insulated electrode holder to provide a strong grip, yet easy thumb-pressure release. Unusually small, the holder is ideal for operat-

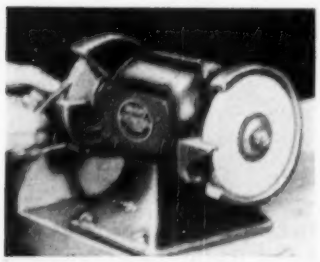
ing with heavy gloves and in corners and confined areas. A highly flexible asbestos-base compound, covering the tip of the jaw end is highly resistant to temperature, abrasion, and impact. Weld spatter will not adhere.

The Lincoln Electric Company, Cleveland 1, Ohio

Fractional-Hp Speed Reducers Stocked in 24 Assemblies

Totally inclosed in a single-piece housing, the DBRA speed reducer is stocked in 24 different right-angle drive assembles and is offered in a range of 1/20 to ⅛ hp, and reduction ratios of 25:1 to 1764:1.

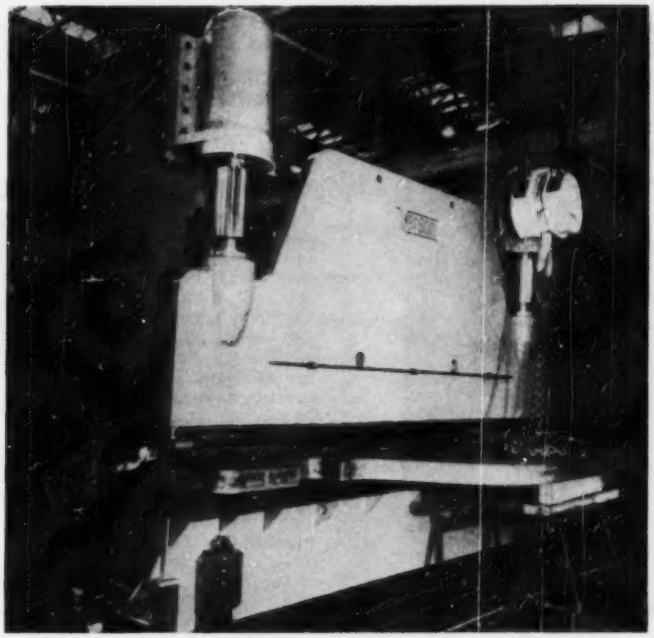
Winfield H. Smith Corp., Springfield, New York.



Bench-Grinder Line Offers Extra-Large Work Clearance

Skil ¼- and 1/3-hp grinders are "flat-faced" to provide full clearance for difficult jobs. Design of the ½- and 1-hp grinders is said to permit easy handling of large and bulky pieces and to allow more accessibility to grinding wheels. The smaller grinders have split-phase motors for quick starting and smooth running, and the large units have capacitor-start motors with low starting current which withstands heavier-duty service. The two smaller units have 6-in. wheels, the ½-hp unit, a 7-in. wheel, and the larger grinder, a 10-in. wheel.

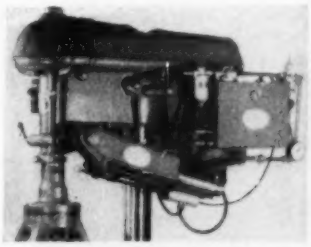
Skilsaw, Inc., 5033 Elston Ave., Chicago 30, Ill.



Verson Press Brakes Are Hydraulically Operated

Streamlined in both appearance and operation, line of Verson hydraulic press brakes are said to bring the advantages of hydraulic operation to heavy plate work. Because of hydraulic operation, they cannot be overloaded and are said to be safely used for bottoming work. These press brakes can deliver any predetermined tonnage to capacity and can produce entire rated tonnage at any point during the stroke.

Verson Allsteel Press Co., 9316 S. Kenwood Ave., Chicago 19, Ill.

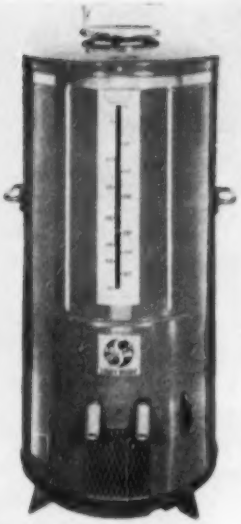


Automatic Air-Power Feeds Are for Small Drillpresses

Proper thrust and correct drilling action for practically any size drill working in any drillable material are said to be provided by the Beckett Air Feed. Accuracy of 0.001 in. is said to be maintained on depth control, no hydraulic checking device is required for light work, and the unit provides instant reversal of thrust on break-through. Stroke speed is infinitely variable in either direction. Operation of the feed is either by hand, trip rod, or momentary-contact pedal which leaves operator's hands free to handle the work.

This drillpress feed is available in either standard or heavy-duty models in drill; drill with dwell; drill, chip, clean, and dwell; and drill and tap. Models are designed to fit all drillpresses with 1¼-in. pinion shaft and can be adapted to shafts or other sizes. Max length of stroke is 2½ in. on 1¼-in. pinion shaft or 270° of shaft rotation. Standard feed develops from 4- to 750-lb drillpoint thrust. Heavy-duty units have 4-in. max length of stroke on 1¼-in. pinion shaft, developing from 10- to 1250-lb drillpoint thrust.

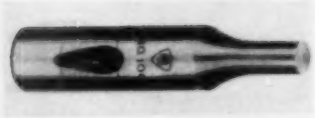
The Beckett-Harcum Co., Wayne Road, Wilmington, Ohio.



Welding Transformer Provides Range of 70 to 580 Amps

Rated in accordance with NEMA specifications, 400 amp at 60% duty cycle, the Model 400E welding transformer retains full 75-v open-circuit voltage. Fan motor and capacitors are said to be easily accessible for maintenance through a hinged door at the front of the machine. Heavy-duty motor and fan blades provide high-velocity air to clean and cool the coils. Commercially available secondary connectors are standard equipment. Welder is priced at $395.

A. O. Smith Corp., P. O. Box 584, Milwaukee 1, Wis.



Interchangeable Round Punches Made of High-Speed Steel

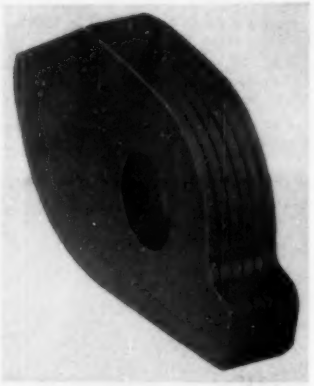
Round punches incorporate the R-B interchangeable feature in which a ball-bearing lock in the retainer engages in the ball seat on the punch shank, providing secure positioning, both radially and vertically. This design permits instant insertion or removal of the punches. Punches of special shapes or sizes are made to customers' specifications.

Richard Brothers Div., Allied Products Corp., 1560 E. Milwaukee Ave., Detroit 11, Mich.

Screwdriver Pin Keeps Tight Grip on Screws

Screwholding screwdriver has rotating hardened-steel pin in the center of the blade which tightens the grip on the screw as force is applied to turn it. The screwdriver is rated at 65-in.-lb torque.

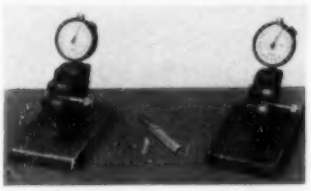
H. D. Hunter & Co., 4476 Union Pacific Ave., Los Angeles 23, Calif.



Copper-Brazed Cams Are Made of Stamped-Steel Laminations

To reduce cam costs, even on relatively small lots, cams are made of stamped-steel laminations, stacked together and copper brazed into a single unit. They are said to be approximately equal in strength to those made from solid steel and can be heat-treated by conventional methods. A complete engineering and designing service is available without cost.

Technical Metal Processing, Inc., East 55th St. at Lake Court, Cleveland 1, Ohio.



Tri-Roll Thread Comparator Speeds Quality-Control Inspection

Externally threaded parts to be measured on the Tri-Roll Comparator are cradled between two stationary gaging rolls and a third roll, mounted on a preloaded armature, is swung into contact. A dial indicator, graduated in 0.00025-in. increments, gives cumulative readings of errors in lead, angle, and pitch diameter. Where a check on PD only is desired, rolls with only two ribs are used. Ribs are truncated to $\frac{3}{8}$-pitch flat on their major diameter and cleared in their minor diameter. When arranged with two-rib rolls it may be used for checking PD diameter of three-fluted taps. By transposing bottom rolls, right- or left-hand threads may be checked.

Pratt & Whitney, Div. Niles-Bement-Pond Co., W. Hartford, Conn.

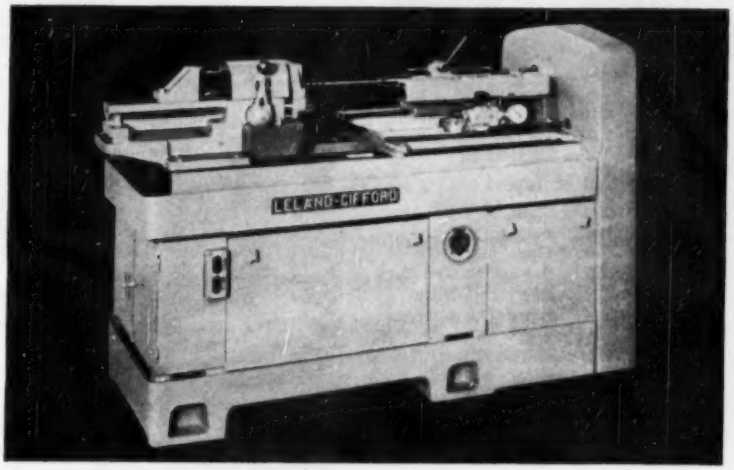
HORIZONTAL MACHINE performs 22 operations on a water pump body, combining operations previously done on three special machines. It drills, reams, faces, bores, chamfers and hollow-mills 90 pieces per hr at 80% efficiency. The machine employs two opposed hydraulic units (one with 25 spindles and the other with five spindles) and a 17-station, 27-in. indexing drum. During the process 12 holes are drilled and four surfaces are machined.—*Barnes Drill Co., 830 Chestnut St., Rockford, Ill.*

THE LELAND-GIFFORD WAY *Is The Best Way To*

DRILL DEEP HOLES

QUICKLY • ACCURATELY • SAFELY

- INFINITELY ADJUSTABLE FEED RATE
- STEP BY STEP HYDRAULIC FEED
- USE STANDARD DRILLS
- NO WORK ROTATION
- RAPID APPROACH
- QUICK RETRACTION
- CLEARS THE CHIPS
- FLOOD COOLING
- OVERLOAD PROTECTION
- DRILLS STRAIGHTER HOLES
- REDUCES TOOL WEAR
- PREVENTS DRILL BREAKAGE
- AUTOMATIC STOP AT PRE-SET DEPTH
- RETURNS AND RESETS



LELAND-GIFFORD HYDRAULIC FEED DRILLING MACHINES

To drill deep holes with maximum speed and precision, without costly drill breakage and with minimum drill wear and replacement the drill must be withdrawn from the work at frequent intervals to:

(1) CLEAR THE CHIPS **(2) COOL THE CUTTING EDGE**

The only safe, sure way to do this is with the patented Leland-Gifford *Step by Step* Hydraulic Feed which automatically retracts the drill at *definite, predetermined* steps . . . before the drill point can reach a critical temperature and before the flutes clog with chips.

The Leland-Gifford *Step by Step* Hydraulic Feed can be furnished for horizontal drilling as illustrated by the Single Spindle, Self-Contained, Horizontal Deep Hole Drilling Machine shown above, or for vertical or angular drilling . . . in steps and total traverses to meet your requirements.

If you drill holes more than 4 diameters deep, it will pay you to check with Leland-Gifford. Write for complete information.

PRODUCTION MEN

Get This Handy Slide Rule. A valuable aid in figuring costs and setting production schedules. Quickly gives time required to drill holes of any size and depth in any material. It's free. Write the nearest office.

LELAND-GIFFORD

Drilling Machines

WORCESTER 1, MASSACHUSETTS, U.S.A.

- CHICAGO 6, ILL. 565 W. Washington Blvd.
- DETROIT 26, MICH. 1533 Dime Bank Bldg.
- CLEVELAND 1, OHIO P.O. Box 5547
- NEWARK 2, N. J. Industrial Office Bldg.
- ROCHESTER 4, N.Y. Commerce Bldg.
- LOS ANGELES 14, CAL. 724 South Spring Street

Tedious Setups Eliminated In Inspection of Tapers

With the Taper-Chek, it takes less than two minutes to inspect taper-shank tools and taper-plug gears to within 0.00002 in. in 4 in. The operator assembles the proper combination of angle blocks which are then mounted with the work, and an indicator reading is taken. The Taper-Chek gives the same answer wherever an indicator reading is used. Comparator, sine bar, space rolls, and knife edges are eliminated. The Taper-Chek will measure up to No. 60 milling machine tapers.

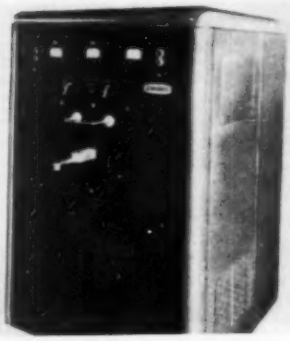
Webber Gage Co., 12912 Triskett Road, Cleveland 11, Ohio.

Hydraulic 5-Ton Press Built in Floor, Bench Models

The self-contained pressure unit of the Brandt 5-ton hydraulic press is quickly removable from the frame and is adaptable for a variety of purposes. A relief valve prevents overloading, pressure gage is optional, and the pressure unit can be used in vertical or horizontal position. The bolster is easily adjustable to operator's use and ram end is both removable and adaptable to other tools.

Bench model specifications: height, 33½ in.; width, 19 in.; weight, 85 lb; area of ram, 1½-in. dia; ram stroke, 5 in.; bolster adjustment, 12 in.; and bolster-increment adjustment, 3 in. Floor model specifications: height, 54 in.; width, 19 in.; weight, 110 lb, area of ram, 1½-in. dia; ram stroke, 5 in.; bolster adjustment, 27 in.; and bolster increment, 3 in. The bench model is priced at $59.50 and the floor model $69.50.

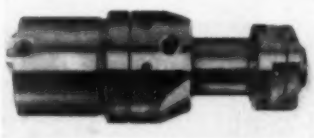
The C. R. Brandt Machine Co., Inc., York, Pa.



Induction Heater Available In One- or Two-Station Models

On 100% duty basis the LI-10 induction-heating unit can provide more than 10 kw into a suitable load. Single- and two-station models are available with high- and low-impedance terminals at each station. Input power is 230 or 460 v, three phase, 60 cycle. All filament voltages are automatically regulated by constant-voltage transformer, and the oscillator tube is air-cooled to eliminate large-volume water requirements.

High-Frequency Heating Division, Lindberg Engineering Co., 2444 W. Hubbard Street, Chicago 12, Ill.

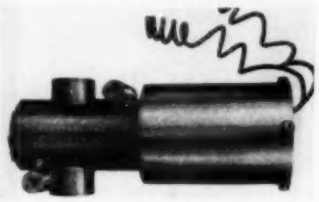


Hydraulic Cylinders Built for Push-Stroke Applications

Hy-Power line of hydraulic cylinders is built especially for push-stroke applications using up to 5000 psi. Cylinders are intended for use in combination with Hannifin's Hy-Power generator which supplies pressure up to 1000 psi. for approach and return stroke, then automatically multiplies pump pressure by five for the power stroke.

The cylinders are available in nine sizes ranging from 2- to 7¼-in. bore, and with stroke up to 6 in. on largest sizes. Output force on push applications ranges from 7½ to 100 tons with 5000 psi on the head end of the piston.

Hannifin Corp., 1118 S. Kilbourn Ave., Chicago 24, Ill.



Two-Way Solenoid Valve Used With Oil, Air, or Water

Poppet-type solenoid valve, for applications where heavy-duty constant service is required, can be obtained in either normally opened or normally closed models, for use with oil, air, or water to pressures up to 1500 psi. The valve is produced in voltage increments ranging from 6 to 220 dc. The valve has two ½-in. NPT ports with wax flow of 5½ gpm. Reduced bushings are supplied where NPT ports of ⅜, ¼, or ⅛ in. are required.

Electrol Inc., Kingston, N. Y.

Nosed-Over Section Added To Power-Belt Conveyor

Nosed-over delivery section added to the Rapistan Floor-Veyor, Jr. provides easy transfer of materials from inclined to horizontal conveyor units or vice versa. Sections are factory installed on both 10-in and 16-in. belt widths. A standard cam-rack bracket permits attachment of a feeder section or a direct hook-up with a gravity conveyor line.

The Rapids-Standard Co., Inc., Dept. No. D, 342 Rapistan Bldg., Grand Rapids 2, Mich.

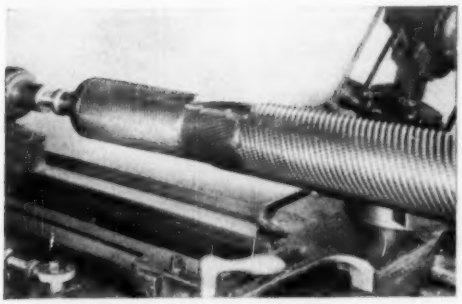
5000 Internal 5" Helicals per Tool Sharpening

. . . at 2 gears per minute, floor to floor.

. . . to tolerances of 0.0003 for involute and 0.0005 for maximum cumulative spacing error.

That's the sort of job broaching is doing—using Colonial machines with Colonial fixtures and Colonial broaches, engineered to produce as a team.

Thus, for gear cutting too, it pays to check what Colonial can do to cut your costs.

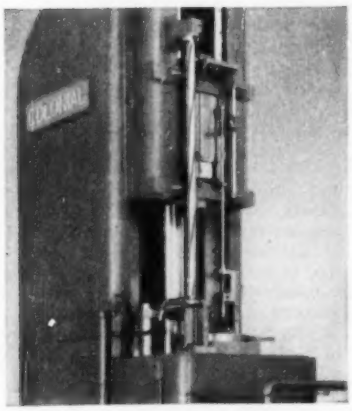


THE BROACH? Combination solid (for roughing) and shell type (for finishing). Also sizes I.D. at same time.

PIONEERS OF H.S.S. BROACHING

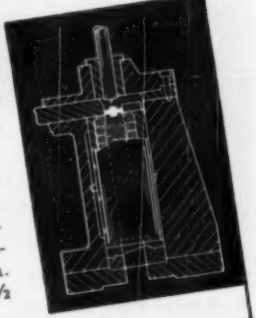
COLONIAL

BROACH CO. DETROIT 13



THE MACHINE? A Colonial Pull-Down with automatic broach handling, shuttle type fixture and automatic clamping.

SMALL GEARS, TOO!



This instrument gear (¾" pitch diameter, 14½° P.A.) is finish cut on a Colonial press in one pass by pushing it through stationary broaches. Automatic ejection at bottom. Complete cycle time 6½ seconds per gear.

Copying Machine Compensates For Varying Power Conditions

The Ozalid Streamliner is a positive-printing, dry-processing copying machine which provides constant printing speeds despite varying power-line conditions. Constancy is obtained through the use of a constant-wattage transformer which controls voltage fluctuations within the 200-250-v range. This stabilizer is standard equipment on all new models.

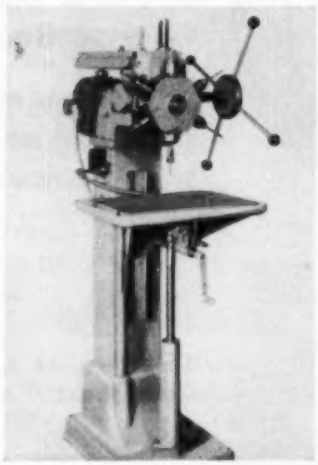
The Streamliner incorporates a free-flowing developer circulatory system which insures consistent development of all copies to optimum line density. An instantaneous speed control permits quick changes in operating speeds from 0 to 10 fpm and vacuum-box sealing prevents leakage. The unit accommodates material up to 42 in. wide and develops up to 5 fpm. Electrical consumption: starting 22.5 amps, 220 v; operating at 19.5 amps, 220 v.

Ozalid, Div. General Analine & Film Corp., Johnson City, N. Y.

Small-Tool Kit Added to Mechanics Handtool Line

Kit of Wellock tools, assembled in a transparent plastic case, contains general utility pliers, self-gripping angle-nose pliers, blunt nosed forceps, and a screwdriver. All tools are hand made drop forgings of chrome-alloy steel with precision-milled teeth, said to be scientifically heat-treated. A special lug, forged on the male half of the pliers, fits into interlocking wells on the female half so that only slight opening or closing of the jaws gives any required adjustment. Light pressure locks the lug in the well giving a vise-like jaw grip.

The Palmer Wellock Tool Co., Meadville, Pa.



Drilling, Tapping Machine Has Automatic Indexing Turret

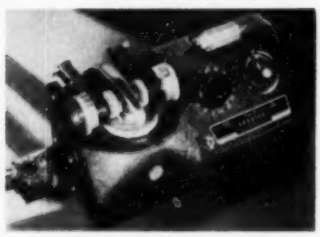
The Burgmaster six-spindle drilling and tapping machine is used for drilling, spot-facing, threading, counterboring, reaming, tapping, and any other secondary operations. With the automatically indexing turret, any sequence of these operations is obtained. With slight up movement of the feed lever the clutch is automatically disengaged, the locating taper pin is withdrawn, and the head indexes to the next position. When indexing is completed, the location pin enters the taper-slot hole, locking the head in position and the drive clutch engages the next spindle. Any spindle may be by-passed by repeating the slight up movement of the feed lever, and each of the six spindles can be operated at a different rpm through use of high, medium, or low gearing on the spindles. Automatic change of the two-speed motor is made according to pre-selected pattern. Power is applied only to the spindle being used. A positive stop may be set for each spindle and coolant is supplied from a tank and pump in the base of the machine. Spindle run out is held to 0.004 in. max T.I.R. at a distance of 10 in. from chuck and 6 in. from center of spindle.

Burg Tool Mfg. Co., 3743 Durango Ave., Dept. A-100, Los Angeles, Calif.

Swivel-Based 4-In. Vise Has Beveled Graduated Edge

The bevelled edge of the base of this vise reads from 90 to 0° in two directions allowing synchronized readings for markers on either side of the vise. Hardened-and-ground removable steel jaws are 1¼ in. deep x 3⅝ in. wide, x 5/16 in. thick. The vise opens to full 4 in. and may be used independently of the base. It weighs 16 lb.

Kenco Mfg. Co., 5211 Telegraph Rd., Los Angeles 22, Calif.



Machine Tests Abrasive Resistance Of Solids, Coated Surfaces

The Taber Abraser incorporates the company's rotary rub-wear action of dual abrading wheels. The right wheel rubs the specimen from the center outward and the left wheel rubs from the outside toward the center resulting in the criss-cross pattern. Action is continuous throughout the 360° rotation of the specimen and closely approximates abrasive wear encountered in actual use. Two sets of stainless-steel weights, in addition to the weight of the arm, provide three standard ranges of wheel pressure against the specimen, namely 250, 500, and 1000 gg. A variety of holders have been developed for different kinds of specimens. Both qualitative and quantitative wear results are obtainable with the Model 140 Abraser.

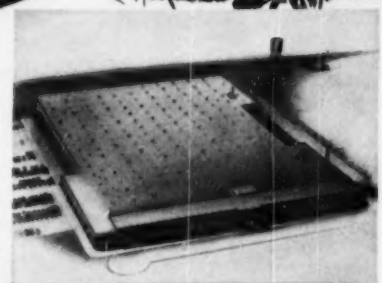
Taber Instrument Corp., 111-AM Goundry St., North Tonawanda, N. Y.

"AMERICAN Screw Company?

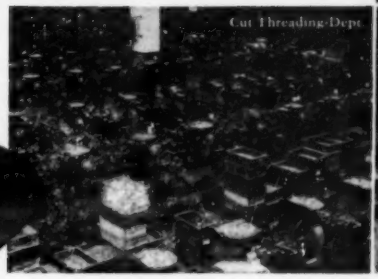
. . . please call the NEW NUMBER . . . at WILLIMANTIC CONNECTICUT!"

4-WINGED DRIVER CAN'T SLIP OUT OF PHILLIPS TAPERED RECESS

Phillips



Wire Storage



Cut Threading Dept.

Shipping Dept.

Slotted

. . . and get fastest fastener-service from this modern, high-production plant

Save time and "wrong numbers" by changing your records *now* to the address of American's new main plant and home office.

This high-production operation . . . one of the most modern in the screw industry . . . is equipped and staffed to raise American quality and service to new high levels, both in American Phillips Recessed-Head Fasteners, and also slotted products. Whatever it takes to make better screws, American has it at Willimantic!

Photos at the right give you a good picture of American's present position on deliveries. So for either Phillips or slotted, mark your order *American* . . . and shoot it to Willimantic.

AMERICAN SCREW COMPANY

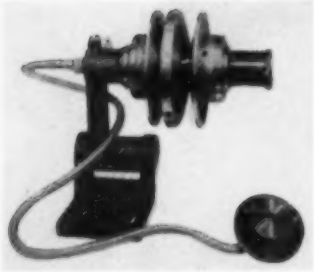
Plants at Willimantic, Conn., and Norristown, Pa.

Warehouses at:

589 E. Illinois St. Chicago 11

502 Stephenson Bldg. Detroit 2

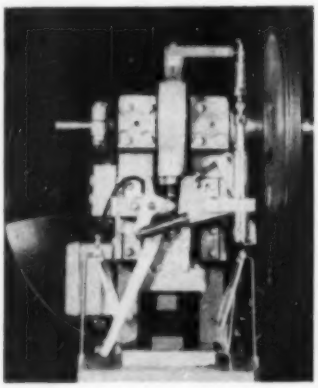
AMERICAN SCREWS



Variable-Speed Pulley Offers Positive Sheave Setting

Adjust-O-Matic pulleys, designed for drives of ¾ and 1 hp, provide speed ranges of 3:1, in the plastic models equipped with steel-faced sheaves. An aluminum alloy model delivers a 2:1 range on drives of 1, 1½, and 2 hp. Positive sheave location minimizes ratio slip under varying or cyclic loads. Spacing between sheaves is set by mechanical control which holds regardless of belt wear, pull, or stretch.

American Type Founders, 200 Elmora Ave., Elizabeth B, N. J.

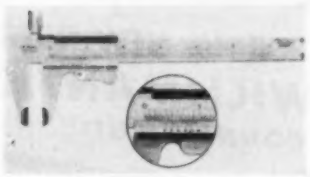


Transparent Press Guard Provides Dual Protection

Anderson safety guards are made to fit each individual machine and are available for presses with strokes from 1 to 6 in. inclusive. For normal operation the operator controls the closing of the guard with a pedal. When the guard closes a sliding shaft falls into place locking it, after which the press is automatically tripped by solenoid coil, controlled by cam action. This unit avoids the crack on the wrist an operator can get from sweep guards.

In case of a repeat, clutch or other mechanical failure, the guard is ram-operated. It is so timed to the ram that the hand is removed from the die space before the ram has completed one-half of its downward stroke. This timing is a permanent part of the guard which cannot be altered.

Jamestown Safety Guard Corp., 170 Hopkins Ave., Jamestown, N. Y.



Spring Lock on Calipers Eliminates Slipping

Tuna precision vernier calipers are said to be made of best Swedish steel and can measure internal and external lengths as well as depths. The instrument is equipped with a spring lock to insure against slipping. Measuring length, graduated in 0.001 in., is 5⅜ in. Depth of external jaw is 1⅝ in., and internal is ⅝ in. Depth measurement is from 0 to 5⅜ in. Net weight 5 oz and price is $9.75.

Swedish Gage Co. of America, 8900 Alpine, Detroit 4, Mich.

Electrical Recycling Timers Repeat On-and-Off Time Cycles

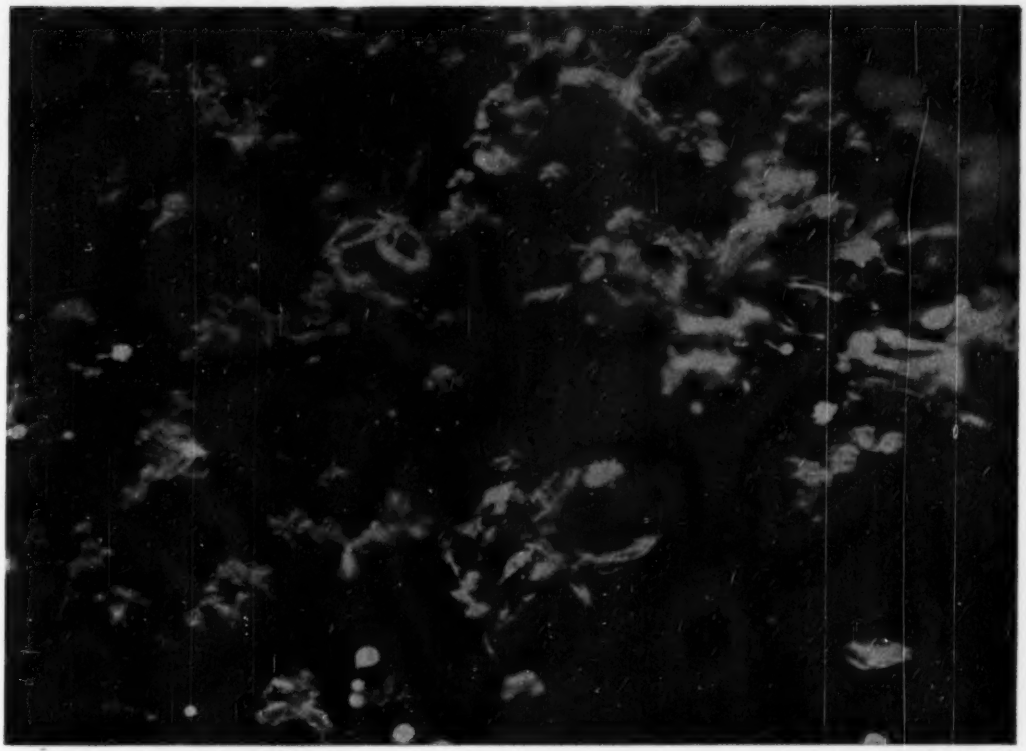
Cam recycling timers are designed to repeat definite electrical on-and-off time cycles and are said to be extremely suitable for controlling innumerable industrial operations. Fifty different over-all time cycles can be obtained from one Series CM timer, and 650 in all from 11 timers in series. Each cycle is capable of furnishing up to 98% length on-and-off periods. The unit consists of a heavy-duty synchronous motor, an adjustable cam, and a single-pole, double-throw snap-action switch. Assembled on a steel chassis, the unit is 3 1/16 x 2 1/2 x 2¼-in. and can be mounted against a back panel with four 6-32 screws.

Industrial Timer Corp., Newark, N. J.

Worktable and Quench Tank Added to Induction Heater

Combination worktable and quench tank can be easily attached to Lepel vacuum-tube or spark-gap converters. With a sink cover on, this unit forms a 29x56-in. worktable for mounting work coils and fixtures. The center portion of the table top may be removed, uncovering a brass (or stainless steel) quench tank 24x-24x18 in. deep, fed by 1-in. waterline, solenoid controlled. Heating and quenching cycles are controlled by a three-circuit timer operated by pushbutton or pedal.

Lepel High Frequency Laboratories, Inc., New York, N. Y.



Aspergillus magnified 78X.

Beat the "Bugs" to the Draw!

Bacteria and mold are the sworn enemies of lubricants and coolants. When they become numerous, the oils sour, causing machine down-time. Now you can ward off costly attacks by these microorganisms *before* they result in expensive production delays and wasted materials.

Dowicides, Dow's industrial germicides and fungicides, incorporated in cutting, grinding, rolling, and hydraulic soluble oil emulsions, will guard against the growth of bacteria and mold, thus increasing the service life of the oils.

Beat the "bugs" to the draw. Investigate Dowicides today. Dow maintains complete laboratory facilities to help solve your problems. Contact your nearest sales office or write direct.

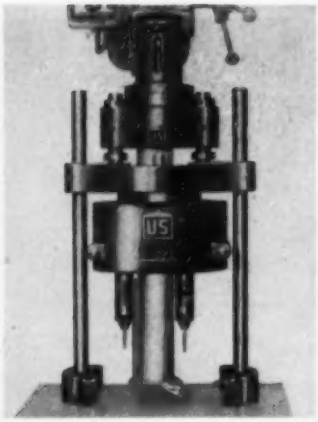
THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN
New York • Boston • Philadelphia • Washington • Atlanta
Cleveland • Detroit • Chicago • St. Louis • Houston
San Francisco • Los Angeles • Seattle
Dow Chemical of Canada, Limited, Toronto, Canada

use the

Dowicides

Industrial Germicides and Fungicides

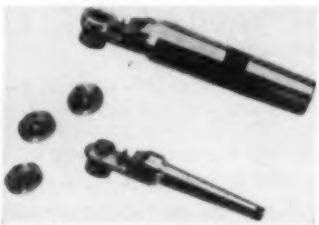
DOW CHEMICALS
INDISPENSABLE TO INDUSTRY AND AGRICULTURE



Adjustable Tapping Head Offered in ¼- to 1½-In. Sizes

These drillheads, available in 56 sizes and five types, can be equipped with single-purpose tap chucks, floating tap holders, or safety tap holders which prevent tap breakage and permit holes to be tapped to the bottom. By locking the tapping unit the complete setup can be used for drilling as well. The drillhead is a heavy-duty unit with drive through positive-tooth clutch of heat-treated alloy steel. Gears are of the same material. Drive is geared to reverse the taps three times as fast as tap feeds. The attachment is adaptable to any drilling machine, round quill, or flange spindle.

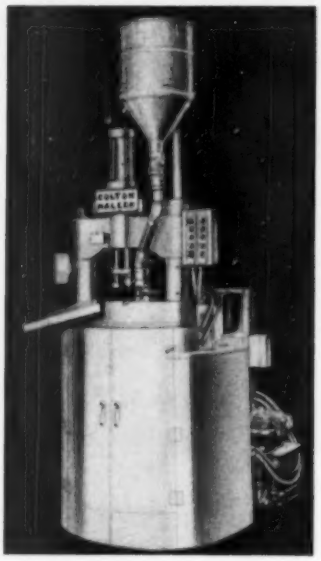
United States Drill Head Co., Dept. T, 616 Burns St., Cincinnati 4, Ohio



Exchangeable Hollow Center Reduces Wear, Dressing

The Dero hollow center incorporates both a center and an exchangeable center disk with 16 centers distributed over its circumference. Each of 8 different sizes of centers is directly opposite one of equal size on the ring. A springy index point allows engagement of a center which is then fixed by screw. The centers can be used in turning, milling, round surfacing, and thread-grinding operations on all machine tools on which work with centers of 60° are machined. The centers are supplied with Morse cones 1, 2, 3, and 4, and special cones of standard tool-making lathes. Center disks are available with centers ranging from 0.5 to 3 mm. in OD of taper.

Cosa Corporation, Room 684 Chrysler Bldg., 405 Lexington Ave., New York 17, N. Y.



Powdered-Metal Presses Built Up to 125-Ton Capacity

The Colton-Haller vertical, single-punch hydraulic presses, developed by Michigan Powdered Metal Products Co. will be built and marketed by Snyder Tool and Engineering. They will be made in the following capacities: 25-ton with 5-in. fill, 40-ton with 8-in. fill, 100-ton with 9-in. fill, and 125-ton with 9-in. fill. The 25-ton unit is a two-tierod press, and the others have four tierods. Fills are adjustable from 0 to the machine's capacity and filling is by means of a reciprocating-shoe mechanism for powdered-metal work. A shuttle feed is available for plastic preform work and all machines are designed for rapid approach speed and slow pressing speed.

A wide variety of motions are available in these presses; one from above and one from below with stationary core-rod; one above, two below, both pressing motions; one above, two below, one of the latter a pressing motion and the internal motion a movable core-rod; two above and one below; and two above and two below.

Snyder Tool & Engineering Co., Detroit, Mich.

Self-Positioning Gage Checks Internal Groove Diameters

For quality-control inspection during production, the Nilco Dial Groove gage measures internal groove diameters and recesses used for precision retaining rings of the Truarc type, ordinary snap rings, O-rings, and oil and washer grooves. The gage nose has two extensions. Upper extension has gaging pin set between 2 prongs of the patented one-piece plunger. The prongs, with a 60° chamfer and a flat edge slightly less than groove width, center pin in groove and position axis of pin through exact center of bore.

The lower extension, with fixed gaging insert, is pulled in by a trigger when inserting the nose into a housing. Releasing the trigger locates the groove. Dial indicators can be provided in 0.0001-, 0.00025-, or 0.0005-mm calibrations.

Nilsson Gage Co Inc., Poughkeepsie, New York.

Large-Size Keyway Broach Fitted With Staggered Teeth

Staggered teeth on the "Minute Man" keyway broaches for cutting ⅞- and 1-in. keyways provide ample chip room for heavy cuts in long bores. The cutting teeth are ground with a sufficient number of chip breakers to reduce the force required to push the broach through the bore. Shank end of these large broaches is provided with a ½-in. reamed hole for quick locating and alignment of extension shank. A shank is furnished with each broach. The large cutter is shown alongside a 1/16-in. broach to give an idea of relative size.

The du Mont Corp., Greenfield, Mass.

KNOW ABOUT *NEW* "FLEETWELD 72" for high speed production welding?

• **Welds Faster.** Operates efficiently over a wider current range than conventional E-6012 electrodes. Operates best at currents substantially above conventional E-6012 rods . . . and without overheating.

• **Welds Easier.** Unique arc characteristics assure proper root penetration on fillet welds without sacrificing speed . . . minimizes the danger of cutting away the top edge on lap welds (Fig. 2).

• **Goes Farther.** "Fleetweld 72's" near flat bead shape (Fig. 1) means maximum weld strength without excess weld metal . . . eliminates piling up of weld metal so common with other E-6012 electrodes to give greater weld length per rod.

• **Ideal On Poor Fitup.** Permits easy bridging across gaps at high currents and high speeds without burning through parent metal to simplify fabrication and fitting of parts in fixtures for welded assembly.

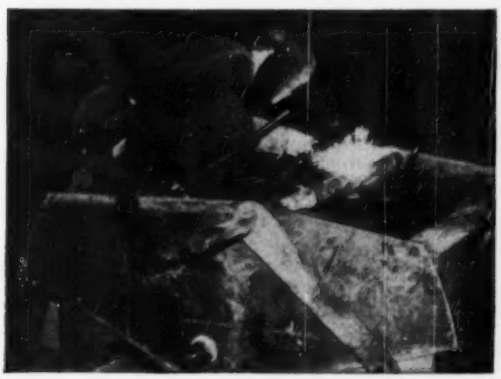
• **Needs Less Cleaning.** Smooth, uniform operation over broader current range minimizes spatter . . . On many types of work, slag is practically self-cleaning.

• **Premium Performance At No Extra Cost.** New "Fleetweld 72" combines the benefits of greater ease in producing properly shaped bead with higher welding speeds to cut your welding costs . . . *yet new "Fleetweld 72" sells at no increase in price* over its famous E-6012 welding partner "Fleetweld 7".

NEW LINCOLN "FLEETWELD 72" E-6012 ELECTRODE

Available in 1/8, 5/32, 3/16, 7/32, 1/4, 5/16 diameter. For use with AC or DC.

VERSATILE FOR WIDE RANGE OF WORK as in the fabrication of machinery parts, automobile frames and bodies, storage tanks, shop fabrication of structural members . . . and for all types of flat-position repetitive work where duplicate welds must be made in a minimum of time.



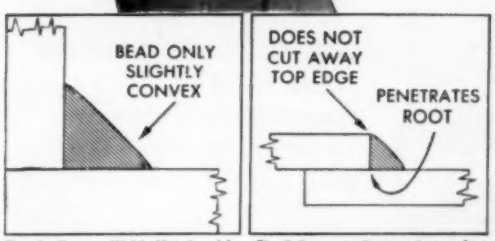


Fig. 1. Proper Weld Metal *with "Fleetweld 72's" near flat bead means greater "mileage" from each electrode.*

Fig. 2. Prevents Cutting-Away *of top edge on lap welds . . . weld flows up to catch top edge without sacrifice in speed. Prevents piling up of metal.*

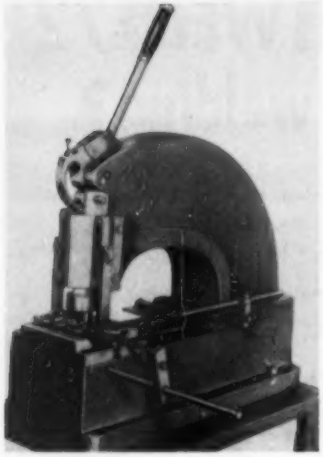
GET THE FACTS

Write for free Procedure Bulletin

THE LINCOLN ELECTRIC COMPANY

Dept. 106, Cleveland 1, Ohio

Sales Offices and Field Service Shops in All Principal Cities



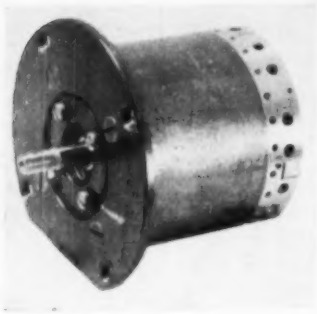
Bench-Model Punch Built With 12-In. Throat

Di-Acro Punch No. 2 perforates holes of various shapes and sizes as large as 4-in. dia, and can be used as a precision punch press for a variety of blanking, drawing, embossing, and forming operations. A 12-in. throat allows working to centers of sheets 24 in. wide.

Action of this machine is obtained through a roller-bearing cam of exclusive DI-ACRO design which provides the operator with a high mechanical advantage. A triangular-shaped ram, hardened and precision ground for extreme accuracy, prevents turning or twisting and the punch head is positively controlled, assuring perfect alignment at all times.

A flexible gaging arrangement, built into the punch, provides precision location of material for exacting operations. Capacity is 2-in-dia hole in 16-gage steel plate, and larger sizes, in proportion, to 4-in. dia or equivalent. Throat height is 3 3/16 in. and hole in ram is 1 in. Bed dimension is 6x7½ in.

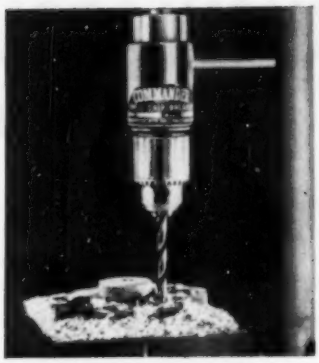
O'Neil-Irwin Mfg. Co., Lake City, Minnesota



Fast-Action Magnetic Clutch Has 0.2-Hp Capacity

Designed for servos and other devices where rapid engagement and release is required, this magnetic clutch has capacity of 0.2 hp with an input of 3 watts. When the electromagnet is energized, the cork-faced driven disk is clamped between two drivings members. For high-torque transmission the driven disk is faced on both sides. Splined bore in driven disk permits easy coupling to the load. Driving plates are ventilated for rapid cooling. Maximum torque is 4 in.-lb and maximum speed is 3600 rpm.

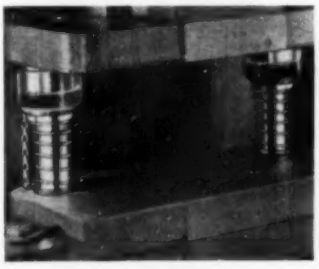
Barber-Colman Co., Rockford, Ill.



Drill Chip Breaker Designed to Boost Production and Drill Life

Manufacturers claim the Commander drill chip breaker will increase drill production 100% or more and increase drilling speeds up to 50% over commonly accepted standards. It is also reported to increase drill life and the number of holes between sharpenings. Short chips produced by the chip breaker are said to give free cutting action and to allow coolant to flow down flutes to reach the point of the drill. This unit is reported to eliminate the necessity of withdrawing drills to clear out long chips which might clog the hole, break drills, and shut off flow of coolant.

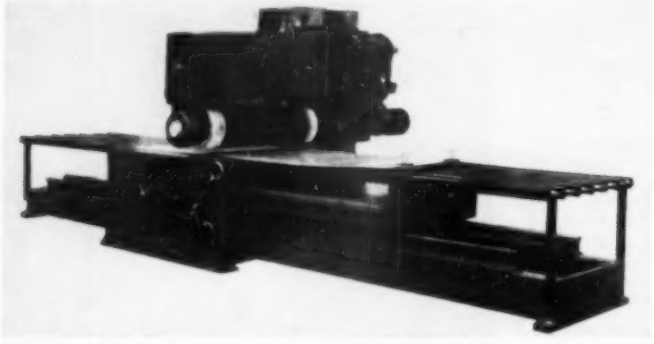
Commander Mfg. Co., 4225 West Kinzie St., Chicago 24, Ill.



Plastic Die-Set Oilers Improve Die Performance

Longer life for pins and bushings, less down-time, and better die performance are claimed to result from use of Die-Co oilers. Each cup is made of clear, shock-proof plastic, molded to an aluminum insert which is fitted with a neoprene O-ring to prevent loss of lubricant and wipe abrasive dirt from pins. The unit has a tapped hole for attaching a chain to stop the oiler at correct height where bushings leave pins.

The Die Supply Co., 5549 St. Clair Ave., Cleveland 3, Ohio



OPENSIDE OSCILLATING sheet-buffing machine has hydraulic table and power elevating and lowering head for 18-in.-dia buffing roll or Tampico brush roll. Oscillating mechanism is powered by 3-hp motor and has stroke variation from ½ to 2 in. and range of 50 to 150 cycles per min. Main spindle is powered by 50 to 100 hp. Machines are built in table widths up to 72 in. and lengths of 8 ft. and over.—*The Hill Acme Co., Cleveland, Ohio*

HOW LARGE IS YOUR *Invisible Staff?*

THE Field Engineer calling at your desk is never alone. He brings with him, in addition to his own years of experience, the combined "Know How" of a nation-wide group of experienced machine tool men backed up by their respective research, product development, product engineering, and manufacturing personnel.

Seldom, if ever, is a processing problem peculiar to only one plant or one part. Other manufacturers have had problems similar to those you are facing. The organizations represented by the Machine Tool Field Engineers have helped solve these problems. They call on every manufacturing plant in the country and in so doing accumulate a vast fund of data and experience.

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Your MICROMATIC Field Engineer represents an organization that has been the leader in the development and application of the Microhoning process for twenty years. He offers you a service that is available nowhere else in the world.

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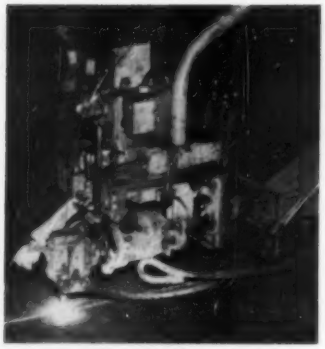


Machine Welds Aluminum by Argon Shielded-Arc Process

Aluminum is welded automatically by the FSM-1 machine which uses an arc, maintained in a shield of argon gas between the consumable filler-metal electrode and the work. The electrode, supplied as a coil of wire, is deposited across the arc into the weld as filler material. The process can be applied to either machine or hand welding and can be used on all metals readily joined by Heliarc welding.

Initial effort is being concentrated on welding of aluminum plate. No flux is used and welds are reported to be clean and smooth. Aluminum alloys, welded commercially by this process at present, include 2S, 3S, 52-S, and 61-S, in plates ¼ to 1½ in. thick. The FSM-1 machine now available can butt-weld in the flat position, and fillet and lap weld in flat and horizontal positions.

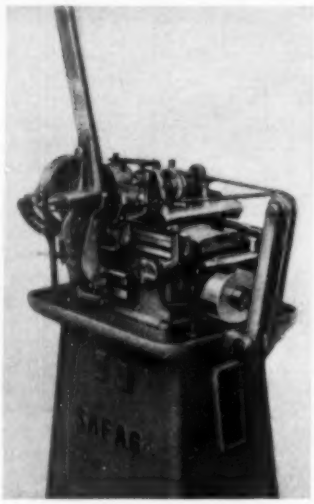
The Linde Air Products Co. unit of Union Carbide and Carbon Corp., 30 E. 42nd St., New York 17, N. Y.

Double-Acting Cylinder Reduces Air Requirement

Though it may sound like a paradox, this double-acting return cylinder is, in effect, a double-acting cylinder requiring only half the volume of air needed to operate double-acting cylinders. After the initial charge of air the cylinder operates on the same volume of air as a spring-return cylinder. Field applications are said to substantiate the company's contention that there is no residual pressure on the forward stroke.

The cylinder may be operated by use of a 3-way valve and still allow throttling to provide for control of work and of the return stroke. Hard-drawn, relief-annealed brass tubing, a stainless-steel piston rod, and aluminum head construction produce a cylinder that is light but strong. There is no metal-to-metal contact, and no moving parts to wear except "O" rings. Therefore, replacement of "O" ring packing completely renews the cylinder.

Modenair Corp., 4222 Hollis St., Oakland 8, Calif.



Precision Gear Machine Has Automatic-Feed Magazine

Swiss wheel-, pinion-, and segment-cutting machine is for precision production of parts ranging from 0.04- to 2.0-in. dia. By using two cutters, one for roughing and one for finishing, the machine assures extremely close tolerances and fine surface finish throughout long production runs. The machine rough and finish cuts pinions of 6 to 80 teeth and finish cuts ones with 6 to 200 teeth.

Work is held to from 0.00005 to 0.0001 in., depending upon the material and requirements of the job. Maximum module (metric) in steel is 1.0, in brass is 1.25, and max tooth length is 1.58 in.

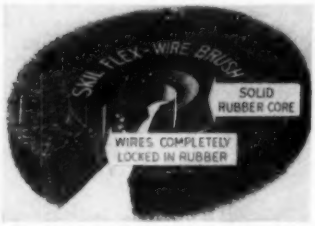
An automatic-feed magazine is standard equipment but can be easily removed for hand feeding. When using automatic feed all functions of the unit are automatic, enabling one operator to handle several machines. Power required is ½ hp and net weight, with stand and motor, is 560 lb.

Hauser Machine Tool Corp., 30 Park Ave., Manhasset, N. Y.

Tempered Dial Glass Replaces Metal Guards on Crane Scales

An impact-resistant dial glass that eliminates need for protective metal guards has been incorporated in Hydroscale hydraulic crane scales. Said to be up to five times as strong as plate glass of equal thickness, this material will bend as much as 20° without breaking. It absorbs a thermal shock of 500° without breaking or distorting. It does not scratch when polished or waxed.

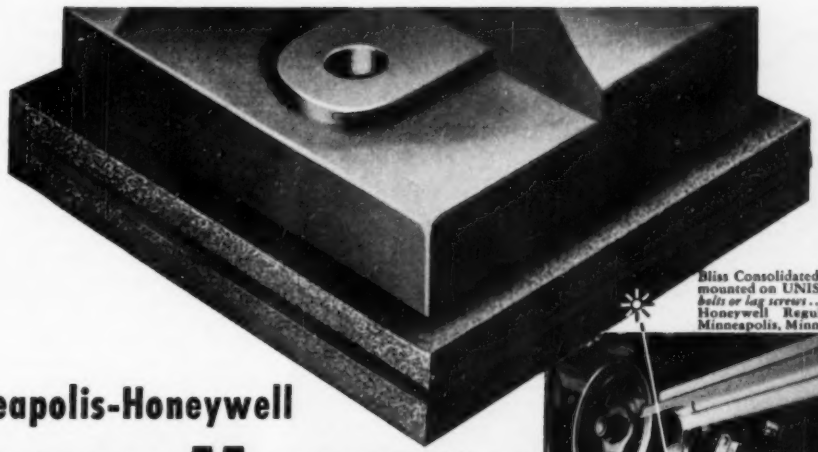
Hydroway Scale, Inc., 20624 W. Eight Mile Road, Detroit 19, Mich.



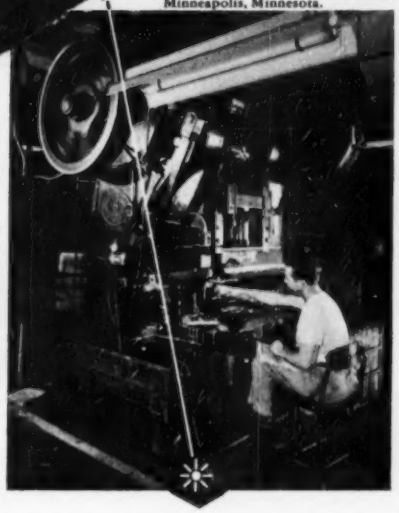
Wires of Skil Flex Brush Individually Locked in Rubber

On the Skil Flex wire brush, the resilient rubber mounting holds wire securely, reducing the danger of flying bristles. Since there is no rigid hinge point to mar work, the brush can be used right down to the core. Individual wires are always in an upright position, keeping a maximum number of cutting points in contact with work. The brush is available in 4-, 6-, 7-, and 8-in. dia. designed for all portable or stationary shop equipment. It is said to be ideal for numerous power-brushing operations such as removing scale, rust, carbon paint, weld spatter, grease, road tar, or surface imperfections from castings, metal parts, and fittings.

Skilsaw Inc., 5033 Elston Ave., Chicago 10, Ill.



Bliss Consolidated #8 Punch Press mounted on UNISORB . . . *without bolts or lag screws* . . . at Minneapolis-Honeywell Regulator Company, Minneapolis, Minnesota.



Minneapolis-Honeywell

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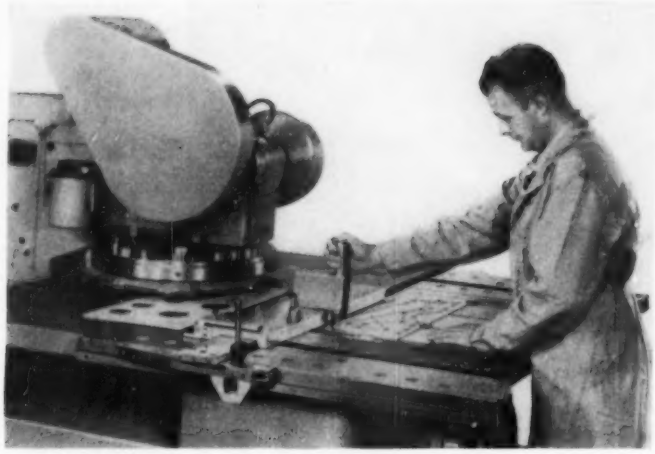
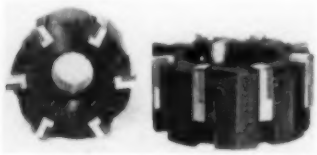


Pantograph System Applied to High-Speed Turret Punch Press

The Pantograph for rapid hole location, and a turret for quick access to punches and dies are combined in the Wiedemann RA-41P turret punch press for high-speed piercing. The machine turret carries 16 to 20 different punches and dies up to 3-in. dia—round, square, shaped, or group units. A handwheel rotates the turret to put any punch and die in piercing position in two seconds. Work is clamped to the cross-slide in proper relation to the templet in which ¼-in.-dia holes have been located to correspond with the center of each hole to be pierced in the material.

By a simple coding arrangement all templet holes representing the same size punch can be connected by a colored paint line to form a visual chain for the operator to follow with the stylus. The stylus is guided by the operator from hole to hole in the templet, accurately positioning the material under the ram. The press is automatically tripped after the stylus point has positively engaged each templet hole. The press handles 28 x 40-in. sheets and capacity is 15 tons with an 11/16-in. stroke of the ram. Powered by a 1-hp, 3450-rpm motor, the unit does 175 strokes per min.

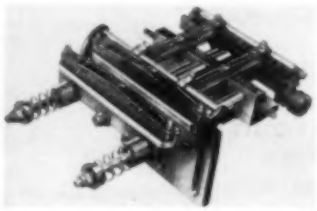
Wiedemann Machine Co., Dept. 17, 4272 Wissahickon Ave., Philadelphia 32, Pa.



End Mills Offered In 3-, 4-, 5-, 6-In. Diameters

Carbide-tipped replaceable serrated back blades of the shell end mills are said to be firmly held, easily adjusted, and able to withstand high table feeds and provide long production life. Cutters are offered to standard specifications in 3-, 4-, 5-, and 6-in. diameters in right hand only. The number of blades in each case is twice the diameter.

Super Tool Co., 21650 Hoover Road, Detroit 13, Mich.

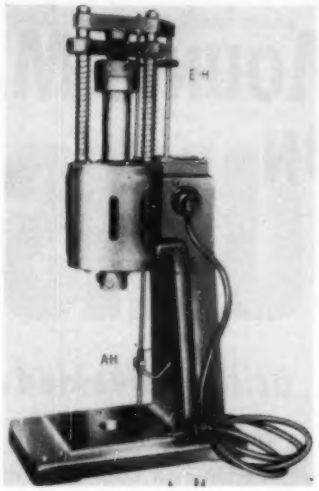


Stock Feed Handles Coil or Strip Stock to 18-In. Widths

Applicable to punch presses, spot welders, drillpresses, and similar machines, the Feedmaster handles coiled or strip stock of almost any size and shape up to 18-in. width and 12-in. stroke. All movements on this unit operate pneumatically. Air-actuated feed head pulls material through the machine, and a pneumatic hold head holds the material, while the feed head returns to reloading position. Gripping capacity of the feed head has been increased by 50% over previous models, and springs, added on the bar supports, absorb shock load, improving over-all machine life.

The Feedmaster operates at over 200 strokes per min, and operation is controlled by either cam-driven air valve or from the ram. The stock feed can be used with plain, compound, or progressive dies, and mounts either on the die or to the machine, either front or back, push or pull. Base cost is $350.

Great Western Tools, Inc., 3811 Riverside Drive, Burbank, Calif.



Ferner Magnetic Ram Press Does Stamping, Bending Work

Ferner press, utilizing the force of a strong electromagnet, is claimed to replace many manual-operated screw presses while affording lower initial cost, lower upkeep, and expanded production. It is said to easily produce 50,000 pieces per 7-hr day. Operating force is adjustable from 45 to 2000 lb. Special machines can be made for higher and lower capacity work. The unit can be operated without fastening either to the floor or a prepared base, thus providing greater portability. Platen surface area is 10x16 in., height above platen, 29 in., and clearance from table to ram end, 9½ in. Average output is 300 pieces per min at full load. Current requirements are 110 to 220 v. dc. Dry or tube rectifiers are available for ac or 3-phase current.

The R. Y. Ferner Co. Inc., Boston 48, Mass.

Hjalmar Ellstrom

INVENTOR OF THE GAGE BLOCK

The achievement of perfection . . . the complete mastery of any art or craft or science . . . is a rare human accomplishment. A discovery or an invention that contributes to the progress and total welfare of all mankind is rarely the heritage left by a single man. So rare is it, indeed, that in such infrequent instances, the true facts surrounding its origin are often distorted, obscured, or even lost in the conflicting claims of others who would seek the personal worldly gains to be derived from undeserved fame.

So it was with the Gage Block. For, actually, this basic standard of measurement now used the world around was originally conceived, developed, and invented solely and entirely by . . . Hjalmar Ellstrom.

Here, briefly, is the story of his accomplishment: During the early 1890's, Hjalmar Ellstrom was employed by the government rifle factory at Eskilstuna, Sweden. He was a master craftsman . . . a man of infinite patience who took great pride in his work. He was a man of vision, too, who recognized the limitations imposed upon industry by the lack of sufficiently accurate measuring devices. So, with a then unheard of standard of precision as his ultimate goal, he alone developed and perfected his checking instruments and techniques . . . then alone he created the world's first gage block accurate to the infinitesimal millionth part of an inch.

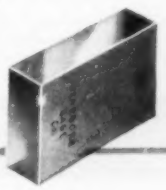
Today, though his achievement has been copied and imitated by others, his personal unqualified devotion to accuracy is the exclusive heritage of Ellstrom.

ELLSTROM . . . *measuring in millionths for three generations*

DEARBORN GAGE COMPANY

22035 BEECH STREET • DEARBORN, MICHIGAN

Originators of Chromium Plated Gage Blocks



PRECISION LAPPING *plus* PRODUCTION SAVINGS!

with the new method **Lapmaster "48"**

- **The lapping plate of the LAPMASTER is automatically conditioned during the lapping cycle . . . no lost time for re-surfacing.**
- **The LAPMASTER quickly laps any soft or hard metals of various sizes and shapes . . . it handles many metal and non-metal parts never before finished by precision surface machines (ceramics, plastics, etc.).**
- **The lapping cycle of the LAPMASTER is automatically controlled . . . skilled labor is not necessary.**

This revolutionary lapping machine answers your need for obtaining precision surfaces at a low production cost. It is easily accessible, simple to operate, and permits continuous lapping without the necessity of down time for lap re-conditioning. Its entire operation is automatic—the lapping cycle is timed, and "wet" compound is distributed to the lapping plate via the feed track in exactly proper amounts.

In one cycle, the Lapmaster "48" will precision-lap such diversified work as hydraulic parts, torque converter parts, bearing faces of pump gears, mechanical seal parts and gauge blocks—all to a flatness of .0000116" and a surface finish of 2 RMS or less. Its efficiency is so great that users have found that it is frequently faster than both the grinding and de-burring operations which it usually eliminates.

The Model "48" Lapmaster has a 48" lapping plate. Other models are manufactured with plate diameters of 12", 24", 36", 48", 60" and 72".

Write, on your letterhead, for a copy of our new, illustrated Lapmaster booklet: Crane Packing Co., Dept. AM6, 1836 Cuyler Ave., Chicago 13, Ill.

The Model "12"...designed for lapping small parts up to 4¼" in diameter.

CRANE PACKING COMPANY
LAPMASTER DIVISION • CHICAGO 13, ILL.
Offices in All Principal Cities in United States and Canada

ROUND TABLE Discussion

EMPLOYMENT PREVIEW

WITHOUT TAKING anything away from the average personnel supervisor, I think there is a great deal to be said for the idea of having the foreman talk to an applicant for work as a skilled mechanic. I do not mean, of course, that the personnel man should be bypassed altogether, but he should be allowed to "screen" the would-be employee in the usual manner before turning him over to the foreman for the final decision. This method often saves the company money in work spoilage and the personnel man the embarrassment of having to make out a discharge slip for what he had considered a very desirable prospect. Added to this is the no small matter of "losing face" with the shop foreman, who is bound to feel aggrieved at having his production schedules disrupted because the p.m. hired someone who promised more than he could perform.

Many a tale has been told of personnel managers who were "victimized" by this type of individual. In the old days along Sixth Avenue New York City, they were known to the clerks in the many employment agencies as "me-mechanics," because their invariable answer to the important question was, "Me? mechanic." Usually they were equipped with a glib tongue and sometimes a more than surface knowledge of their subject, but when put to the test of doing, not talking, a good day's work, they seldom lasted longer than the foreman's patience.

I have in mind the story told by the foreman who heads up the screw-machine department in a nearby plant. During the war, when good setup men were at a premium, the personnel department sent him a man who seemed a likely prospect. He presented himself to my friend's assistant and was duly put to work. He seemed to know his way around the machines—at least while they kept running. As screw machines sometimes do, they keep running for a day or two, then they decided to get temperamental. One by one they were shut down and the men went to work on them. The foreman heard the lull in the song of production and went to investigate; as he went down the line he thought of the new setup man and decided

Are you missing this cost saving?

SOME OF *YOUR* COMPETITORS ARE USING Lusol

AND GETTING UP TO 400% GREATER MACHINE SPEEDS AND USING LESS TOOLS AND IMPROVING THEIR EMPLOYEE RELATIONS

10 million gallons of Lusol solution used in exhaustive testing and practical plant applications, have proved, and in important places, that Lusol as a coolant completely revolutionizes thinking on machine speeds, tool life, and production costs.

BASED ON A NEW CONCEPT

Lusol depends upon cooling rather than lubrication at the point of tool contact. Lusol makes possible up to 300% to 400% greater speeds, less tool wear, less tool breakage, finer finish and lower cost production.

LUSOL IS GOOD EMPLOYEE RELATIONS

Operators like Lusol because it is a clear, clean solution, like a mild soap. Those who work with their hands in old type coolants all day long have often suffered from skin eruptions. Lusol does not cause skin irritations. Clothes and shoes are kept cleaner — the machines are clean, the work is clean, the shop is clean. This clear solution allows the operator to see the work as the finest drill comes down to the work piece, perfect vision, less operator fatigue. Lusol means longer tool life, fewer tool changes, less wheel dressing; easier, faster, smoother production without increased effort. Of course, operators like it, and we've never found one yet who would be willing to go back to the "old way."

BROACHING

275% greater production per broach grind

COLONIAL VERTICAL BROACH
Metal: No. 3140 Steel Forging
Operation: Broach Tank Track Cap
Ordinary Cutting Oil: 2400 pieces per broach grind
Lusol: 9000 pieces per broach grind

GRINDING OPERATIONS

23 more pieces per wheel dressing

MATTISON SURFACE GRINDER
Metal: No. 3140 Steel
Operation: Finish grind .02" from chuck jaw
Ordinary Soluble Oil: Wheel dressing every 7 pieces
Lusol: Wheel dressing every 30 pieces

DRILLING AND TAPPING

Saved 165 drills

MORRIS SPECIAL ROTARY DRILL
Metal: SAE 1035 Steel Forging
Operation: Drill 2 11/16" holes in connecting rod cap
Ordinary Cutting Oil: Replaced 170 drills per week
Lusol: Replaced 5 drills per week

MORE EVIDENCE

MACHINING

Machining a No. 347 Stainless Steel forging on a Warner-Swasey 3A Lathe, with soluble oil, required three tools to make cut 2-5/16" deep, and change of shovel nose tool after each piece. Now, using Lusol 40-1, the deep cut is made with one tool, and six pieces are produced per shovel nose tool. Savings are obvious, since twenty-five minutes idle time is required for each complete tool change.

MILLING

A Cincinnati Miller removed ½" stock from two sides and cut a groove 2" x 1¾" down the center of one side of a long bar of NE 8749 steel. With soluble oil 20-1, four pieces per cutter grind were produced, with heavy smoking. After changing to Lusol 40-1, nine pieces are produced without smoke before regrinding of tools.

BORING

Tools used on a Warner-Swasey 2A to bore and face a cluster gear forging required regrinding every four hours when cooled with a soluble oil. With change to Lusol 40-1, tool life is increased to sixteen hours, machine runs at maximum speed, production increased.

CASE HISTORIES YOU CAN'T AFFORD TO OVERLOOK

Lusol

SAVES TOOLS • SPEEDS WORK
CUTS COST

NATIONAL DISTRIBUTION . . . WAREHOUSE STOCKS

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222 Brownstone Ave., Portland, Conn.

Please send me your case history material on:
☐ Broaching ☐ Drilling, Tapping ☐ Grinding

Name

Company

Address

1AHBO

Produced with *Speed*—Yet *"Every Gear a Master Gear"*

The Reishauer Tooth Flank Gear Grinding Machine, Type ZA, grinds spur and helical gears (up to 45° left and right) from ½" to 9½" O.D., and from 48 to 6 DP.

Gears ground on the Reishauer are produced speedily—with maximum pitch accuracy and excellent surface finish. Here are two typical examples:

SPUR GEAR		15° ∠ HELICAL GEAR
32	Teeth	76
20	DP	8
1"	Face	1½"
20°	Pressure Angle	20°
.005 to .008"	Stock Removed	.005 to .008"
8 minutes	**FLOOR TO FLOOR TIME**	**20 minutes**
.0002"	Maximum Pitch Error	.00024"
.00015"	Maximum Tooth to Tooth Spacing	.00015"
.0002"	Maximum Involute Error	.00025"
.00016"	Maximum Base Pitch Error	.00016"

Let us help you with your gear grinding problems. Send specifications of your gears and let us estimate grinding times and tolerances. Or, write for descriptive Bulletin ZA 50.

COSA CORPORATION
405 Lexington Ave., Chrysler Bldg., N.Y.17, N.Y.

NATIONAL REPRESENTATIVES FOR: **REISHAUER—Gear & Thread Chaser Grinders—Lead Screw Lathes • BECHLER—Swiss Automatics—Cam Shapers • DECKEL—Engravers and Copy Millers • MICAFIL—Coil Winders • MIKRON—Gear Hobbers • SALLAZ—Burnishing Machines • SCHUTZ — Forming and Cutting-Off Machines • STUDER — Profile Grinders.**

to take a look at him in action. He found him and watched quietly for a few minutes the man's efforts to get the machine going again. When he had seen enough, he walked over and tapped the fellow on an oil-stained shoulder, "Where did you learn to set them up?" he asked. Quick as a flash he got his answer, "Down at Johnnie Muller's." Muller's was a local barroom where the boys went to refresh themselves at the close of the shift, and the selfstyled setup man actually worked there in his spare time. My friend saw the humor of the situation and kept the fellow on, but not as a setup man; and the personnel manager ever after sent all applicants for skilled work to the foreman for his okay.

Robert S. Alexander
Greenville, R. I.

•

IT SEEMS TO ME that one of the foremost problems in the shop today occurs when men are assigned to a foreman without the tacit consent of either the men or the foreman.

I believe that the foreman should have veto power over any applicant for a job in his department. This does not mean that the personnel department should not screen those who apply at the front door; few foremen have time or facilities to go into the intricacies of hiring. But after a man has been interviewed and approved by the hiring office, there is no reason why he cannot be introduced to the foreman and left with him for a few minutes for a chat.

Many good machine men freeze up at the front office; they feel ill at ease and out of their element. But down in the shop the same man may limber up to the foreman and will allow him to judge his qualities more accurately. If, for some reason, the foreman rejects the man, I believe this rejection should be upheld by personnel, at least as far as that department is concerned. There is little to be gained on either side if a personality trait or mutual dislike is present to cause friction from the start. Such a condition only leads to low production, hard feelings, and probably expensive labor turnover.

On the other hand, a machinist who looks good in the front office may lose his shine when he gets among shop men who know specific answers. Here, too, the foreman's on-the-job interview will help cut overhead. It would seem impossible for a personnel manager, who must be generally acquainted with a larger number of jobs, to be able to judge an applicant as accurately as a fore-

ECLIPSE-PIONEER *Foundries*

LEAD THE WAY TO BETTER CASTINGS

It is only natural that castings from the Eclipse-Pioneer Division Foundries are *better,* because every step in their manufacture is carried out by skilled craftsmen—each man an expert in his field and each field backed by more than 20 years experience. In addition to using the most modern machines, techniques and testing devices obtainable, the entire production line is conveyorized to assure rapid and economical service on all orders. If you plan to use aluminum and magnesium castings in your product, make it a point to consult Eclipse-Pioneer. Meanwhile, send for Eclipse-Pioneer's "Book of Facts."

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Aluminum and Magnesium Alloys
Including the recently developed
Cerium and Zirconium Magnesium Alloys

PLEASE SEND ME THE ECLIPSE-PIONEER "BOOK OF FACTS" ON MAGNESIUM, ALUMINUM AND BRONZE CASTINGS.

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PLASTER MOLD CASTINGS

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BENDIX AVIATION CORPORATION
TETERBORO, N. J.

Bendix
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Never Before

SO MANY ADVANTAGES for HIGHEST PRODUCTION

4800 PER HOUR!
3800 PER HOUR!
2500 PER HOUR!

For Top Production

SNOW

FULL UNIVERSAL MACHINES

Air operated, electrically controlled Snow tools are establishing amazing production records daily on a wide variety of work. Just note these typical examples:

DRILLING

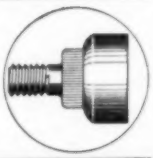
Crossdrill and C'"I" Sink 1/16" Hole
Material—Brass
Production—4800 per hour
Fixture—#15 Vertical index
Equipment—#1-UD Drilling Machine

TAPPING

Tap Two #10-32 Holes
Material—Steel stamping
Production—3800 tapped holes per hour
Fixture—#14 horizontal index
Equipment—#1-UT tapping machine

THREADING

3/8"—24 Thread—1/2" Long
Material—Die Cast Aluminum
Production—2500 per hour
Fixture—#10 Drum dial
Equipment—#3-TR Threading machine



Snow air operated—electrically controlled machines have built in full universal controls that allow selection of the type of spindle cycle desired. This feature also permits instant synchronization of the standard Snow Master Fixtures. All types of air operated automatic and semi-automatic jigs and fixtures are carried in stock. Standardization permits low cost tooling—and—high production.

Sensitivity of power application prevents tool breakage.

Simplicity of control means that set up and operation can be handled by a less experienced operator with minimum fatigue.

SNOW

MANUFACTURING COMPANY

435 Eastern Ave., Bellwood, Illinois (Chicago Suburb)

Single Spindle Verticals • Two-Spindle Verticals • Two-Spindle Horizontals • Automatic Nut Tapping Machines • Drill Press Tap Heads • Automatic & Semi-Automatic Jigs & Fixtures

Submit Sample Parts for Production & Cost Estimate

man who has only a limited number of jobs on his mind.

Although there may be a certain amount of injustice in such a method—and it does consume valuable supervisory time—the foreman will feel more congenial toward men he has picked himself and the men will be more loyal toward a boss who they know had the final word on hiring them.

Donald Wood
Allegan, Mich.

•

I LIKE the 5- or 10-minute encounter with the deck stripped for action—that straight-from-the-shoulder confab that engenders cooperation and bilateral interest. It is a source of encouragement to get in the front line, as it were, and battle with the rough-hewed psychology used by the confident Bull of the Woods.

"Where'd you work last?" one shot at me. "Over at the Non-collapsible C-clamp Company," I bang-banged right back. "What was that foreman's name?" "Do you know the difference between a good finish and good enough?" "Do you drink?" That's one for the books, usually asked by the old timer who probably slipped into the back room and had a swig before leaving for work. This kind of thing could go on and on until you, the applicant, would know what kind of a man you had to associate with during the working hours and what he was going to expect of you, providing you landed the job.

One of the most satisfactory interviews I ever had was with a young engineer who was looking for an assistant to take charge of the tooling up for a new product. I traveled ninety miles for that interview and it took place on a Sunday when the plant was practically idle. I arrived at the plant at ten o'clock, accompanied by the gentleman around the plant at the same time he was plying me with questions pertaining to various operations with the express object of sifting me down to defeat. At noon he took me home, introduced me to his lovely wife, and had me share a roast chicken with its trimmings. Following toothpicks, we returned to the plant and fought out the original battle of the bulge.

After two more hours of this disintegrating procedure, I was about to say, "Ah, to hell with the job," when he told me that he guessed I'd do. We climbed the stairs to his office and sat down for a further chat about the job to be done when he shattered my hope with the fol-

CASE 222

BEARINGS

A bearing manufacturer employed 200 in his inspection department. Fingerprints on highly polished surfaces had to be removed by buffing and polishing, until RUST VETO 256 (fingerprint neutralizer) was used to immerse parts immediately after inspection. Now this temporary preventive protects bearings in shipment as well as preventing fingerprint corrosion.

CASE 322

MACHINES FOR EXPORT

Machines shipped to the Argentine in open crates had been protected by Rust Veto. During the unloading they were dropped into the bay and stayed at the bottom for a year. When finally salvaged they were still free of rust, thanks to the protective coating.

VETO RUST WITH RUST VETO*!

[THESE MEN DID]

CASE 470

WHEELS

Cast steel wheels which are not painted before shipment are being protected by Rust Veto. Wheels roll through a trough containing an 8 to 1 emulsion, then into the freight car. The film dries rapidly. The same user employs the same Rust Veto in rinse tanks of washing machines, 5 quarts to 1,200 gal. of water.

CASE 231

PISTON RINGS

Piston rings made for export were stored after the war in an unheated building for three years, coated with Rust Veto and wrapped in wax paper. When examined, parts were found to be in perfect condition, no trace of rust.

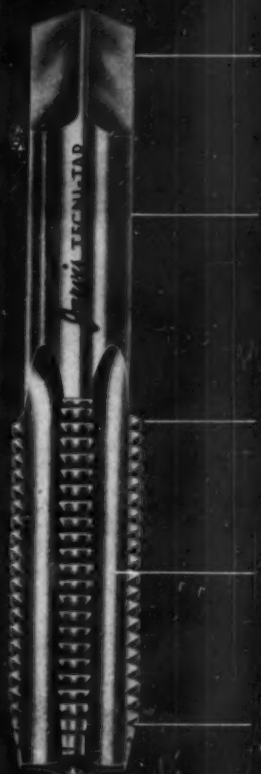
CASE 428

DIESEL PARTS

A diesel builder uses Rust Veto 110-D for coating of gaskets, cables and metal parts where the coating does not have to be removed. He ran a 6-months outdoor test against other corrosion preventives — Rust Veto won by protecting fully against rust spots or flaking.

* Reg. U.S. Pat. Off.

CUSTOM MADE
at NO EXTRA CHARGE



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TECNI-TAPS

JARVIS POWER TOOLS
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TECNI-TAPS
ROTARY FILES
FLEXIBLE SHAFTS and
QUICK CHANGE CHUCKS and COLLETS

THE CHARLES L. JARVIS CO., MIDDLETOWN IN CONNECTICUT

lowing: "I'd like to hear from another applicant I have in mind before deciding definitely," he frowned; "I'll get in touch with you in a few days."

By this time the works manager arrived to do a little Sunday work at his desk facing my inquisitor. The W. M. delayed proceedings in order to find out the outcome of the final skirmish. I detected a look in his eye that seemed to say, "Well! What say?" I brought the interview to a close by telling the M.E. that he could make up his mind right then or the deal was off, to which the W.M. slapped his hand on his knee and laughed. "Hire him, Bill; he's got guts."

So there you are; take your choice. Have some inexperienced personnel clerk pull the wool over your eyes, or go to bat with the Big Boss direct and come out with flying colors and a full stomach. Incidentally, when the W.M. left nine months later he took me with him and shoved me up another notch in so doing.

J. Homewood
Ontario, Calif.

•

WHILE WAITING for an employment interview in a large eastern aircraft engine factory a few years ago, I saw one of the interviewers hold up a paper. Apparently it was an application. "Look," he said, and laughed. "Here's a man who says he can operate a thread mill." This hardly seemed to be a joke, but obviously this interviewer was inexperienced and is an example of how one can be treated by a "specialist" in an employment office.

The present system in this same factory is such that the foreman of the department needing the employee, whether skilled or not, makes the final decision. However before the applicant is allowed this decisive interview, he (or she) is subjected to a cross-examination by one of these "specialists," who only knows what informtaion has been passed on to him by another, what a toolmaker or machininst should know, or what he should look like. These "specialists," who don't work at these trades, can't be expected to know how different industries employ this kind of skilled help. Only a toolmaker or machinist, one having practical experience, knows if an aircraft-engine plant has work for a plastic mold-maker.

I like the system used by certain smaller companies. The personnel department is told that certain skilled positions are open. When the applicant presents himself and makes his claims, he is allowed to speak

LUCAS OF CLEVELAND

Announces...

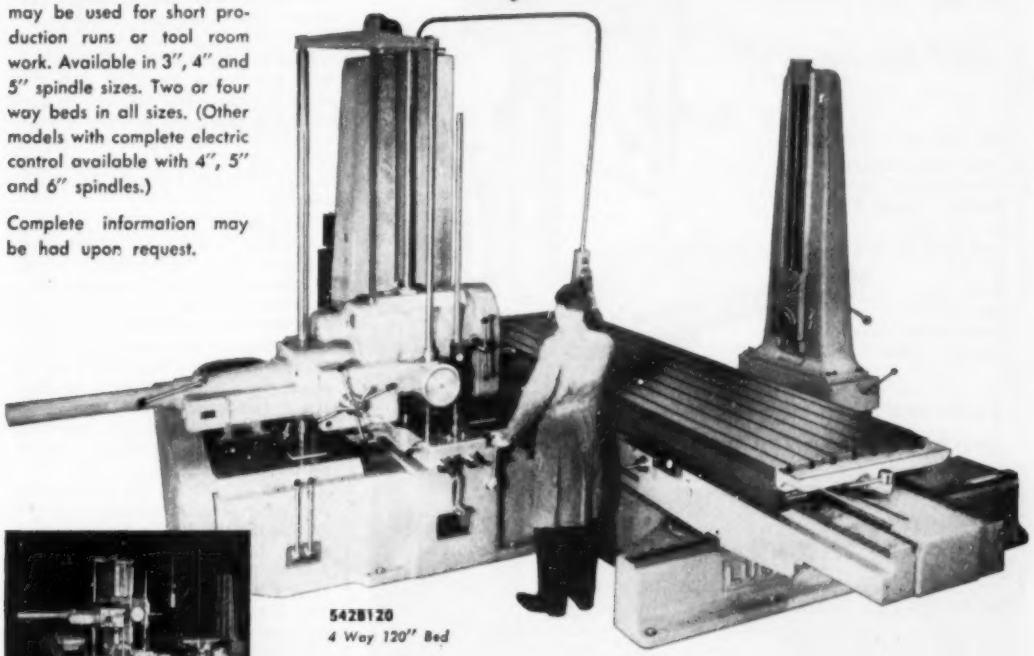
New models

IN 3", 4" and 5" SPINDLE MACHINES

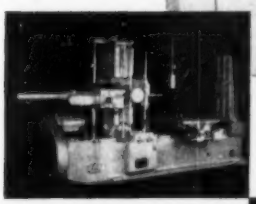
Here is an entirely new series of Horizontal Boring, Drilling and Milling Machines . . . streamlined successors to the rugged, versatile succession of models for which Lucas has been famous 50 years.

Automatic power positioning with simplified, fool-proof controls (available on all models) makes these Series B machines faster on long-run precision production. Standard end measuring rods may be used for short production runs or tool room work. Available in 3", 4" and 5" spindle sizes. Two or four way beds in all sizes. (Other models with complete electric control available with 4", 5" and 6" spindles.)

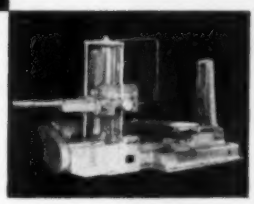
Complete information may be had upon request.



542B120
4 Way 120" Bed



41B24
2 Way 24" Bed



42B60
4 Way 60" Bed

LUCAS *Precision*

HORIZONTAL BORING, DRILLING AND MILLING MACHINES
LUCAS MACHINE DIVISION, THE NEW BRITAIN MACHINE CO.
CLEVELAND 8, OHIO

with the foreman under whom he is to work. The man is less likely to try to "bluff" his way into a job. His time is saved, and he feels he is being respectfully treated. I base this on my own experience. This interview is the acid test, and if passed, wages can be also discussed, and on a sound basis. Finally this interview can be the beginning of a close relationship between foreman and employee.

E. Diskavich
Torrington, Conn.

•

KICKBACKS

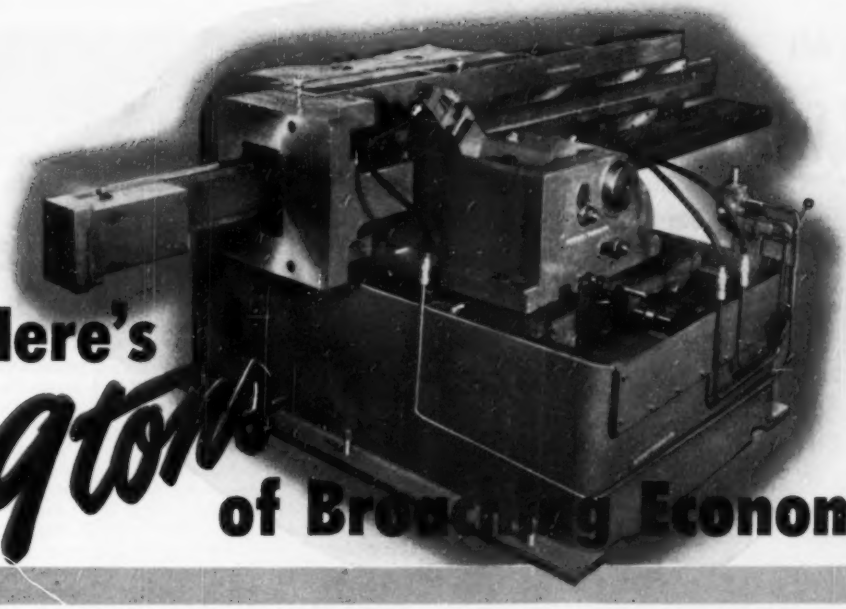
THE INCENTIVE plan, either group or individual, if properly set up in practice would not bankrupt the company. Given the proper time studies, a system could be put in motion that would give the employee the opportunity to increase his earnings and at the same time generally cut down costs of manufacturing product.

I have personally been associated with the group incentive plan for several years. We set up certain standards of quality and that's what we work to. Quality is the result of serious intention, sincere efforts, thoughtful direction and skillful execution.

We can and do maintain quality-mindedness in the workers under the incentive plan. No employee wants to make bad work. The good leader does not bawl the worker out for a mistake, but he does tell the workman what he did wrong and why. On the other hand the worker knows when he does good work he gets along better with the boss. This boils down to the simple fact that the best-laid plans will not work if people don't.

In my opinion we should seek opportunities to appreciate how a worker does his job. Find some particular ability to respect in every man before finding fault. Recognize the good merits to help correct the faults. The biggest job in the plant is to get things done and it is done through people. Our batting average is pretty good in this human aspect of our job, but it is still the part that bothers us most. It is people who bother us and we must learn more about people.

Top officials in both labor and business tell us we must have capacity production. We all know that, but how? They can't do it and we can't do it, although we are hitting the ball better now. We will get capacity production when people get good and really ready to do it. The harder we work on human relations



Here's *gobs* of Broaching Economy!

HERE'S THE STORY—

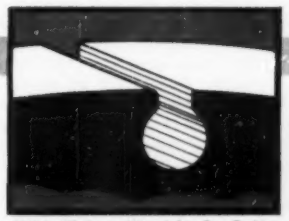
This giant floor-type fixture (measuring 6′ x 8′) is saving money three ways for a manufacturer of gas turbine compressors. It is convertible to eliminate the possibility of a number of broaching fixtures, its completely automatic cycle saves production time and it is producing parts to extremely close dimensional and surface finish tolerances not otherwise obtainable.

To maintain rigidity throughout the long broaching stroke, 8′ ground ways guide the broach bar for its entire length. Power is provided by a 25 ton x 72″ horizontal broaching machine which is attached to the end of the 13 foot main slide. This makes it possible to hold slot depth (±.002) and angularity of the slots (±0°–5′). Further, the fixture has enough "beef" to provide a rigid base for the broach guide and to eliminate vibration—thus assuring uniform smooth surface finish.

The work-holding fixture is mounted on a shuttle table which automatically moves outward and indexes at the end of each broaching stroke. When the broach has returned to starting position, the table moves inward to cutting position again. The tolerance on slot spacing is ±.001—non-accumulative.

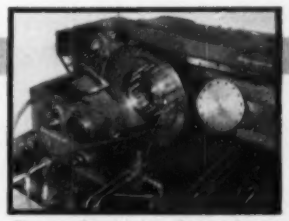
Naturally, not all broaching fixtures are this large or need to be. But this *is* a typical example of the design ingenuity and manufacturing facilities that are to be had at Detroit Broach. These are two of the important reasons why leading manufacturers turn to Detroit Broach on all broaching problems—whether "tough" ones or not. Chances are it will pay you to investigate, too. Why not now?

DETROIT *Broach* COMPANY
20201 SHERWOOD AVENUE
DETROIT 34, MICHIGAN



THE PART: Rotor Wheel for Gas Turbine Compressors. Above is shown the slot-form to be broached in varying sizes, at various angles, from part to part. Tolerances are small and the finish must be extremely smooth.

Close-up of the work-holding fixture adapted for 14″ wheels. Fixture is designed to hold parts as small as 6″ dia. and has an indefinite maximum diameter. There are 24 different wheels whose diameters range from 14″ to 24″.

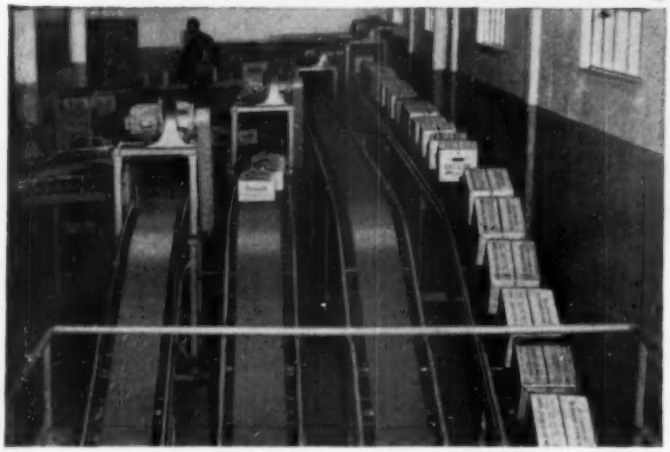


Close-up of work holding fixture adapted for 24″ dia. wheels. Fixture is adjustable to machine slots at any angle from 0° to 45° and for any number of indexes from zero to infinite.

Look at All

FOUR WAYS To get

Fast Lower-Cost Handling



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2 with the EXTENDOVEYOR

— compact, mobile, easily maneuverable power-belt conveyor unit—handles packages up to 150 lbs.—reaches into cars, trucks, trailers. Available in 4 sizes — 2 models.

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— light, easy to carry and set up where needed. Standard Litewate Sectional Roller Conveyor is a great time and labor saver in loading, unloading, storing commodities. Available in 5 ft. and 10 ft. sections — straight and 90° or 45° curves.

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Standard GRAVITY & POWER CONVEYORS

the quicker we will raise our batting average. In the final analysis we did cut down rejections and we did raise production under the incentive plan.

A. E. Salmons
Philadelphia

•

Let us consider a few of the problems that must be faced if a machine shop bonus or wage incentive plan is to be used equitably and economically:

The first problem is the question of actually setting up standards for work to be accomplished. One cannot afford just to make "guesstimates" on a new die as to the labor involved and the material usage. How can one set up a standard on the complex operations of such a precision piece of equipment as a die? There is no short cut if you desire to have an effective wage-incentive system. You must first establish the operations necessary to build this die. From somewhere you must obtain the time elements for performing these operations. This data must be built up from time studies within your own plant on the existing equipment.

Now that you have the standard, how are you going to apply it? Are you willing to just pay a set figure to any and all that can do the job in less time than normal? Wouldn't it be better to establish a percentage system, paying a percentage extra based on the man's hourly rate of pay? You are suddenly confronted with the problem: Will one man do all the work? If so, can you meet the desired schedule on that die? Should you decide that one man could do all the die building and suddenly a delivery date was moved up and it became necessary to put one or more additional men on the die construction, how will you pay the bonus and who will get the credit for the major share?

Each machine within a machine shop is also a production machine within this plant or at least within somebody's manufacturing plan. Lathes, millers, drills and occasionally jig borers are production machines. Nearly all of these pieces of equipment used for mass or semi-mass production have jobs running on them that are on wage incentives. Thus it seems quite logical that the same machines performing the same type of work and in some cases no more accurately could have wage incentives established on the job performed within the machine shop.

One approach to this has been made and has been quite success-

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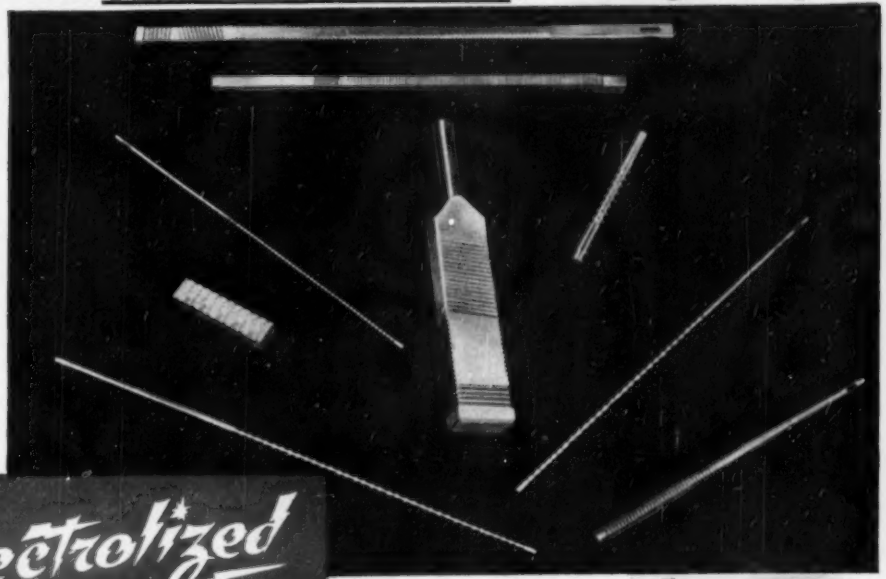
...and no one else, can give you



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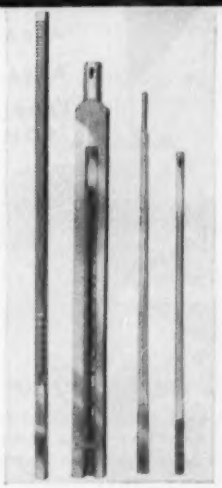

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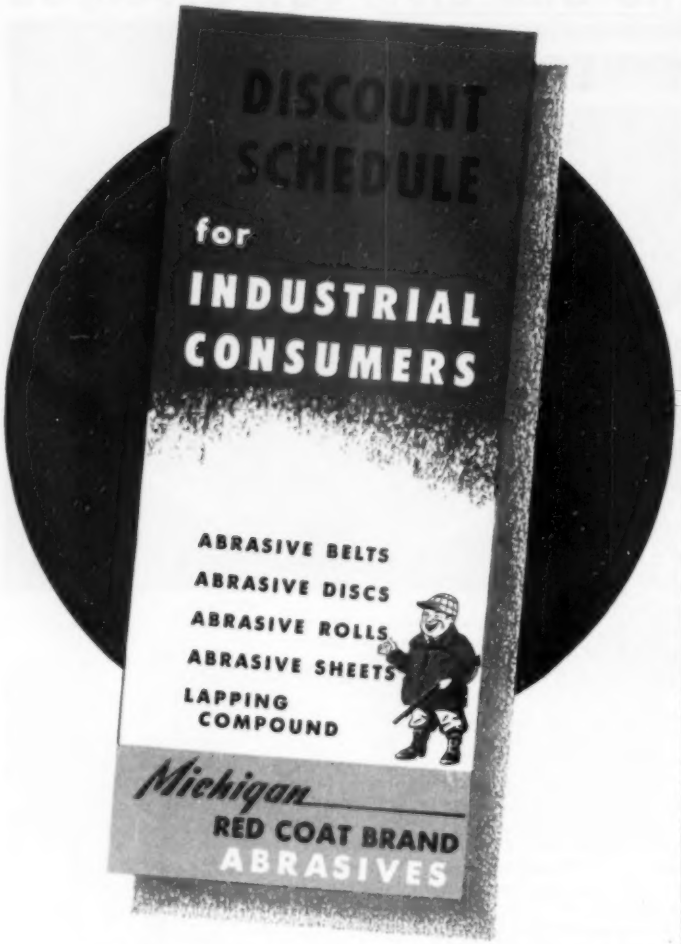

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ful. The machine shop is so established that all machines are manned by experienced operators. Each operator does certain types of work. He does not become a machinist but rather a specialist on a lathe, a drill, a shaper, etc. In other words, the machine shop becomes a production line. This method has some merit providing this shop is used for building new items and not for the repair or rebuilding of dies, jigs, etc. previously built, either within the shop or on the outside. This system does not lend itself to shops of under 25 employees who must be used for both repair and construction. The reason for this is that each man must be an accomplished machinist or a higher classification in order to economically operate the machine shop of the small company of 200 to 800 employees.

In a production machine shop the establishing of wage incentive is made a little easier for here it is possible to obtain time studies on the same type of work and establish rates on such machining. Operational sheets must, of course, be issued with each die showing the standard for each operation. The men then get paid for what they accomplish against standard, always getting the guaranteed base rate in any case and a bonus similar to the production worker in the factory.

Perhaps the biggest problem facing a wage-incentive program in a machine shop is quality. Machine shops building dies must have quality. How can you control this with wage incentives? How can you tie down the error in the production-ized machine shop?

Let's not just kid ourselves that the machine shop can be set up on an easy kickback system. The failures in wage incentives hurt the idea of paying for additional work. It leads employees to believe that industry is not willing to pay. They think that industry, because it has actually failed to do a good sound job of establishing wage incentives, wants them—the hardworking employees—to speed up without paying for it.

Charles D. Townsend
Fort Wayne, Ind.

•

THE QUESTION of the worth and practicability of the "kickback bonus," which is only another variation of the incentive idea, again raises the cry: "Let's scrap incentives! They cost too much and don't give us the production we need anyhow. Give me a good foreman and I'll cut overhead and raise production without

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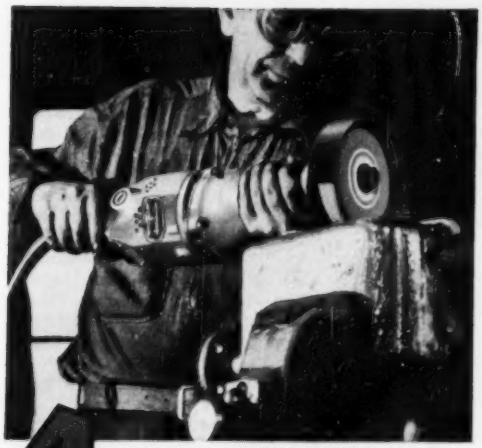

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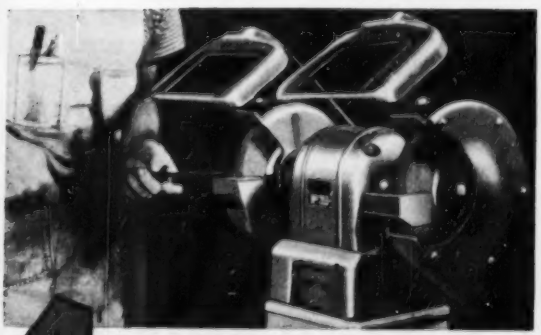

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HY-PRO Taps provide definite production economies because they stay on the job longer . . . require less sharpening . . . produce more accurately threaded holes per tap. Competitive tests on the job prove this economy aids in offsetting high labor costs through greater production.

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benefit of kickback bonuses or any other form of incentive systems."

I believe that this line of reasoning is fallacious. I feel that we should keep the "cents" in incentives. However, shop executives should take a good commonsense look at incentive systems in the light of typical criticisms and the conditions that may be causing them. For example, there is the question: If a shop has good supervision, why is it necessary to have kickback bonuses or other incentives to get the work out in the very best time by promoting that extra effort that workers are always capable of? The answer to that question is that there is no substitute for a well-trained, capable, conscientious supervisor. But let no one underestimate the extent to which the opportunity to increase take-home pay can increase production or beat special estimated time deadlines. The same capable supervision with the aid of a good incentive system can produce veritable miracles.

The statement has often been made that the incentive system is costly. Can't we still get production without spending all this money? Today the cost of operating the incentive system may loom large in management's sight, while the savings that have resulted are hidden under the covers of dusty reports. Such a management needs selling on this point: An incentive system need not justify itself by additional annual savings commensurate with the cost. If you increased production by 30% the first year and by an additional 10% the second, your total savings are 40% for the second year, not 10. As time goes on there is a tendency to forget the earlier figure and to think only of the additional savings that result from refinements of the system.

It is believed that the incentive bonus will promote that extra effort and efficiency necessary to beat the estimate. This extra effort should not adversely affect the caution and precision of the good worker. The efficient man performs with the idea in mind that whatever is worth doing at all is worth doing well and safely.

An incentive system indicates to the worker that he is expected to perform up to his capacity while he is on duty in the factory, while older wage systems did not accomplish this objective effectively. It will stimulate interest and put the spirit of competition into the men, arousing work interest to an extent that can be achieved in no other way thus far developed.

A good wage-incentive plan pro-

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vides opportunity for the worker to increase his average earnings. Under wage-incentive system, people earn in proportion to energy and skill. Increase in earnings are open to anyone who is interested. It is assumed that management is not so short-sighted as to set low top-limits and is foresighted enough to guarantee the rates as production increases result.

The purpose of incentive plans is not to pay the lowest possible wage for the highest output management can get. Paying high wages does not necessarily result in high unit labor costs. Overhead costs remain fairly stable over a period of time, and, as production efficiency goes up, the amount of overhead expense does not go up in direct proportion. If quality is carefully considered in operating the incentive plan and is so maintained that quality workmanship is turned out in reasonable time, the more highly paid workers are actually cheaper.

If the reward is large enough, the worker will take new pride in his work; the pride of having earned more money this week than he did last because he worked better and more effectively. The pride of accomplishment in relation to his fellow worker develops. This is logical and justifiable pride. An incentive bonus system designed to share the benefits which accrue from superior or extra effort on the part of employees is beneficial not only to management but encourages and rewards the individual initiative of the worker.

Harry Kaufman
Philadelphia

•

THERE ARE factors which militate strongly against the possibility of making the kickback practical. Chief among these is the fact that the estimator, whoever he may be, can never hope to provide estimates on different and peculiar jobs in relationship to which he has had little or no previous estimating experience, and maintain even a reasonable degree of accuracy as to what those estimates should be. If and when he overestimates the amount of time that should be assigned to a given job, the worker has a strong advantage, but the profit that will accrue where this is the case is more likely to be imaginary than real. If, on the other hand, he underestimates, the worker will be taken at a definite disadvantage.

If and when the worker is taken at a disadvantage on a piece of work on which the time estimate has been

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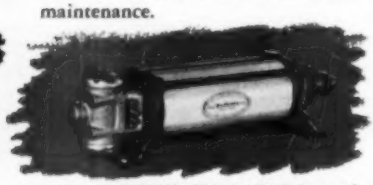

The ELECTROAIRE VALVE is standard equipment on all Bellows "Controlled-Air-Power" Devices arranged for electrical control. It is adapted for direct connection to or remote control of any air cylinder of suitable capacity.

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set too low, he is likely to be disgruntled on two points: First, he has worked exceedingly hard without reward for having done so. Second, the circumstances seem to leave his ability under a cloud.

There are workmen who will resent any seeming implications of this kind more than they will feel injured because of lack of actual reward. One may say that such workmen are emotionally immature, and that may be true, but it does not change the fact of their resentment. Once this happens with any given workman, his enthusiasm has been destroyed, to say the least. Often he will try to bring the kickback system into disrepute with other workmen thenceforward; usually with some degree of success.

If and when a piece of work is assigned to some given workman on which he is able to "come out" to advantage, and another is assigned to another workman on which he is unable to obtain a reasonable kickback, the latter may raise the cry of favoritism, and may represent that the man responsible for assignment of the work deliberately pushes the "poor jobs" his way. Unfortunately, there is enough of a possibility of such a thing being true, where the man assigning the work may like some of the workers better than others, to lend at least a modicum of credence to such a complaint.

If it were possible to alternate or rotate the privilege of a "first choice" among the workers involved, on the basis of their selecting their own jobs from among those to be done, it would eliminate the idea of favoritism being shown. But this is not very practical. It would not then be possible to so distribute the work that each man would receive those types of jobs on which he had shown the highest amount of competency in the past. Neither could the first available worker under such a regime be put to work on that piece of work which was needed first.

John E. Hyler
Peoria, Ill.

•

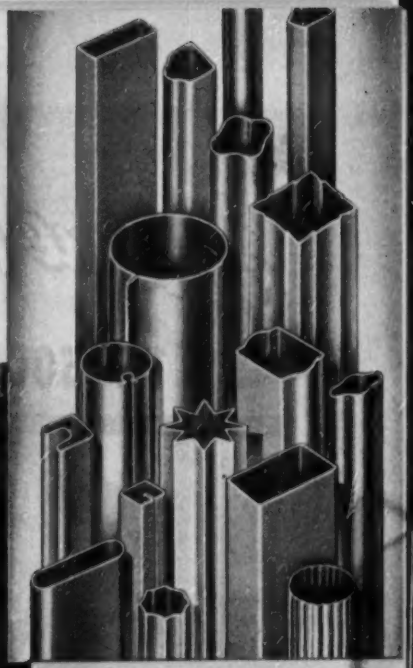
PLANNING COMMISSION

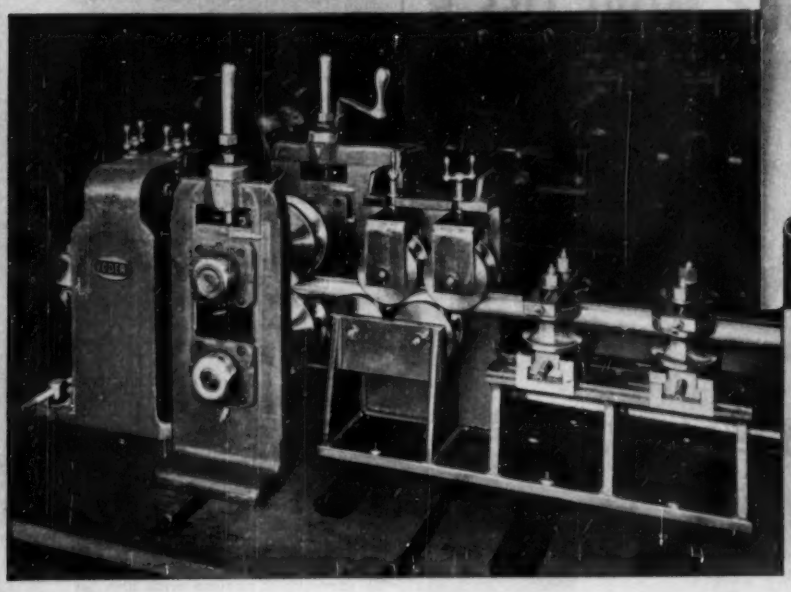
WHEN IDEAS for increased productivity involve the expenditure for capital, it is necessary for the originator of the idea to prepare his argument with great care because the idea has got to be sold to those who keep a tight hold on the purse strings.

Top executives who allocate capital for this or that purpose are apt to look at the technician's schemes for spending money with a very cau-

12 Examples of Economies Effected

by combining different operations in a Yoder Roll-Forming production line





NO. 7

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ONE of the many operations which can be done at the lowest possible cost in a Yoder cold roll forming machine is the making of non-welded tubular shapes, having round, square or other profiles, with edges butting, overlapping, or joined by an interlocking or other type of seam.

In the photo above is shown the series of rolls, mounted next to the exit end of the machine, for folding and joining the edges into the familiar lock seam.

Flat stock, in coils or cut lengths, is automatically fed into the machine at the rate of 30,000 feet or more per day, coming out as finished tubing of almost any desired design, diameter, thickness, and kind of seam, except welded. (For welded pipe and tubing, a Yoder Tube Mill is necessary.)

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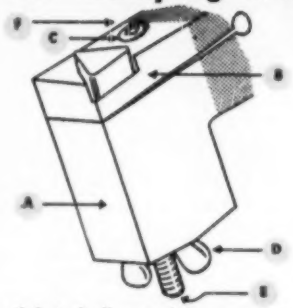

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tious eye, and who can blame them? Every company president has been sold an expensive idea at some time in his career, by an over-enthusiastic technician who has put up a half-prepared argument.

I know of one firm in Britain which is going to spend $140,000 on the world's most expensive die-sinking machine. In my opinion this expenditure is unwarranted because they do not have the work to keep it fully occupied and I know that the technician who is plugging the idea thinks he cannot solve his problem without the machine. There are several alternatives that will be just as effective and cheaper than the expenditure of vast sums on a new "toy."

Company presidents know of the love for new gadgets with which their technicians are afflicted and they do right to look very searchingly into the many money-spending schemes with which they are daily confronted. Technicians who are short on inventive ability are prone to retort with a call for more money for plant when asked for increased production. This is the easy way. Anyone can do it. Many of our British technicians do it all the time instead of trying to figure an alternative way out.

The production man who is striving after greater efficiency should not rush into the president's office with the first idea that comes into his head. Rather should he first convince himself that the idea is good by carrying it around with him for a few days. After a digestive period, he may have thought of an attachment or modification to an existing piece of plant that will solve his problem more cheaply.

Should the expenditure of money be the only solution to the problem, he must then really go to work and prepare his sales talk. This must be detailed, taking into account such factors as depreciation, overheads, maintenance, carefully calculated probable output and the grade of labor needed to operate the new venture. By the time he has accumulated all these facts and has double checked them, he will have convinced himself that he is doubly right. Alternatively, he will probably find that his original idea for spending a lot of money is a snare and a delusion that the expenditure required will leave the firm no better off.

I think many a production executive has his requests refused because he does not prepare his arguments in sufficient detail. He must be able to say what his idea is going to cost,

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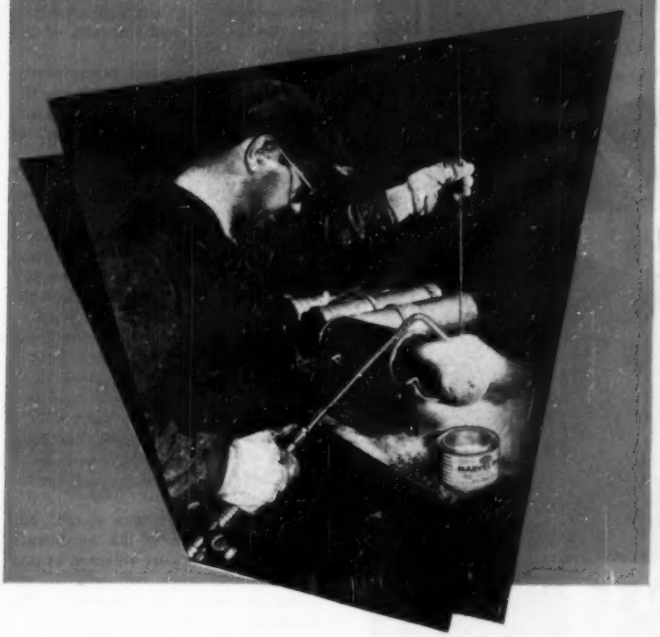

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This well-recognized reputation for top performance didn't just happen—more than thirty years' experience and development have gone into the manufacture of these outstanding gas welding supplies . . . know-how that produces high quality, reasonably-priced items that guarantee a job done faster, done better, done easier and done at less net cost.

For further information about Airco's oxyacetylene welding supplies which includes a complete line of rods, fluxes and brazing alloys, write your nearest Airco Office or Authorized Dealer for a free copy of Catalog 12.

More news about AIRCO products

AIRCO No. 1 ALLOY STEEL

A Smooth-Flowing, High Ductile Rod Insuring Good Control of Molten Pool

This rod (AWS Classification GA60) is ideal for welding low carbon and low alloy steels, including pipe of grades A and B analysis. Outstanding among its many important features is the high ductility in the "as welded" condition. Because of its mechanical properties, this rod is desirable when undertaking qualification tests like those included in The American Standards Association Code for Pressure Piping. It is smooth flowing, insuring good control of the molten pool, and, in addition, will withstand considerable heating without burning.

PHOS COPPER

A High Standard Copper And Phosphorous Brazing Alloy

It is self-fluxing when used on copper-to-copper joints but requires a good low melting point flux when brazing brass, bronze or other alloys. It is completely fluid at approximately 1382°F. at which temperature best results are secured and is used in the manufacture of electrical, refrigeration and air conditioning equipment. Available in rod and strip form.

AIRCO MARVEL BRAZING FLUX

A High Quality Flux That Remains Molten And Viscous Over A Wide Temperature Range

It is a uniformly high-quality flux for use in braze welding cast iron, malleable iron, copper and steel and for welding brass, bronze and copper. Marvel Flux remains molten and viscous over a wide temperature range. Its use protects the weld metal from oxidation and effectively reduces or removes oxides and other foreign matter. Marvel Flux is a general purpose flux for the welding shop.

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how much it will save, what it will produce and how long it will take to install. The president will ask, "What's in it for me?" and the executive should have a firm answer.

F. E. Riley
London, England

•

A PLANNING commission or its equivalent can be built up to act wisely in any plant to formulate the best information about any subject which may be for the best interests of the concern.

At the present time many plants have their committees which are the equivalents of such commissions and are there for the improvement of existing ways and means.

During the war, a small firm accepted a contract to make high-explosive shells. Its plant was in poor condition; its many machines were worse, and its methods were a jumble of poor ideas. There was no system of routing the work through the shop, hence, the product crossed itself nine times in the course of manufacture. There were 41 machines which were used on the work; 38 of them were in such poor condition that they were hardly usable. The monthly loss was $13,000, and as a result there were 72,000 semi-processed shells in the graveyard on the property.

A new manager was sought and from the letters of 22 applicants, four candidates were selected as possibilities and were requested to call (expenses paid) for interviews. The most likely one was asked to call a second time. He came, and upon this occasion he was escorted through the plant with the result that he threw up his hands, refused the opportunity and said it was a shame to call the place a manufacturing plant. The second applicant did practically the same.

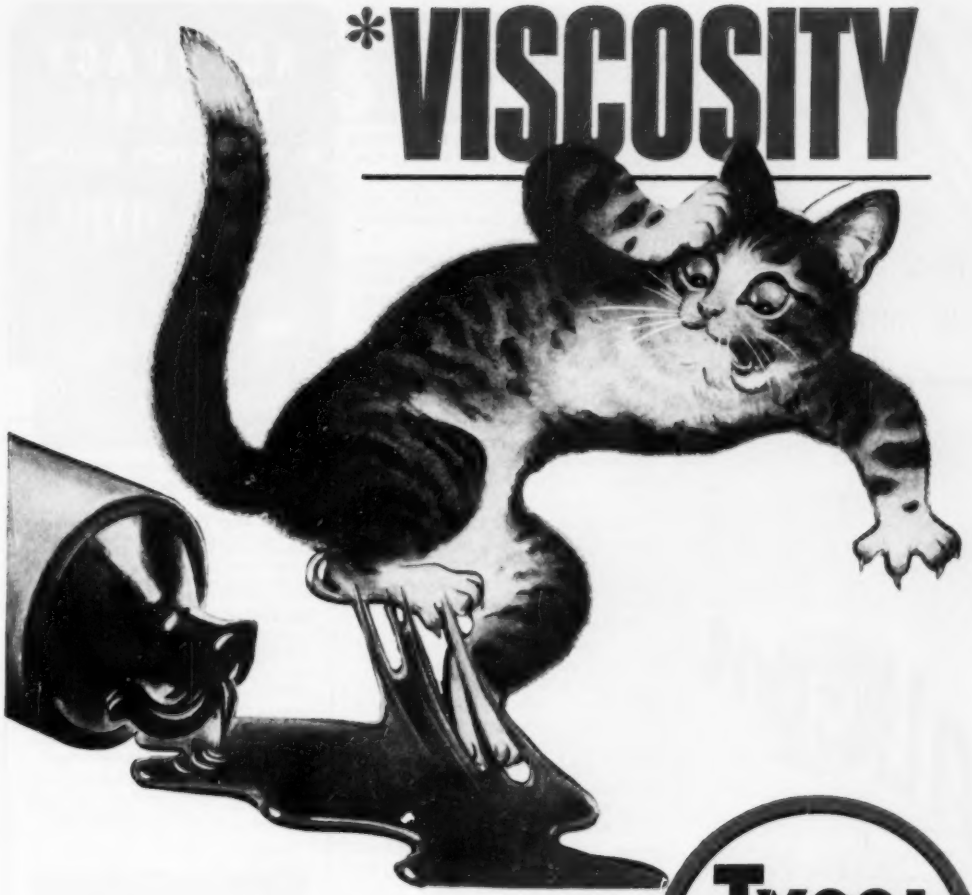
The third, who was a natural-born plugger, agreed to come provided they would agree, in writing, to give him a free hand and also to appropriate sufficient money to put the shell shop in first-class condition. This they did.

Upon taking over he formed a committee of himself, both day and night foremen, and the sales manager.

This committee drew up a flow sheet, then made up a course of action, each taking a share of the responsibility and discussing any changes with the manager.

A good crew of machine repairmen was brought in (with a foreman) from a jobbing shop in the Pittsburgh district where big things

*VISCOSITY



All tools will last longer — give finer finishes — if you use the proper cutting oil. That's why you'll find it profitable to use Tycol high quality cutting lubricants.

There's a reason! No matter what your cutting requirements — for heavy-duty grinding, or the cutting of aluminum, ferrous or non-ferrous metals . . . where *VISCOSITY, flash point, emulsification is a factor—Tycol has a cutting oil suited to your specific requirements.

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are done with dispatch and in a workmanlike manner. These men made bushings, gears and other parts to close limits from the materials at hand.

Result? By such teamwork at the end of the first month the percentage of scrap had been cut to 25%; the end of the second month saw production breaking even; while at the end of the third month there was a small profit.

The point is that all of this was due to the formation of a committee which attempted to improve conditions and things for the benefit of the firm.

Still another case: In a group of four plants there was overlapping of authority and the result was confusion, outright quarreling among managers and department heads, also open rebellion among the men.

These conditions caused excessive labor turnover.

After a number of losses had been incurred, there was a committee formed of 21 men with 5 alternates, most of whom were managers or assistants from the various plants.

This committee was divided into small sub-committees each suitable for a particular plant. When any sub-committee met there were representatives from other plants and, by friendly teamwork, the blisters were ironed out. They made it common practice to call in, for consultation, foremen or mechanics who had put good ideas in the suggestion boxes.

The scope of their discussions was almost unlimited and embraced all subjects which had to do with the welfare of the corporation.

It was a case where two heads were better than one.

F. H. Stebbins
Worcester, N. Y.

•

BROTHER'S KEEPER

"Say, Bill, d'ye remember Tom Matson who used to work at Jones' place, across the way, a little stinking kind of fellah, a bit of a roguer who drank a lot?"

"Ah yes, Jack. I think I do. Wasn't he always hard up and trying to borrow a nickel or a dollar? The sort of chap who never looked you straight in the face; was he not sacked for doing something shady, stealing tools or something of the kind? What about him, has he got jailed or anything like that?"

"Oh, dear, no, nothing like that. He is said to be smart with the tools, and Ed, one of Jones' foremen has started him again."

"That seems a rum go, Jack. It seems like advertising that shady

ACCURACY TO .0001"

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Internal grinding on lathe with PRECISE wheel arbor mounting 1½" D. wheel.

LOWEST COST PRECISION. When mounted on standard machine tools, PRECISE SUPER 40 at speeds from 20,000 to 45,000 R.P.M. turns out precision jobs heretofore possible only on stationary machines costing up to 100 times as much.

VERSATILITY. For cylindrical, internal, external and form grinding; for milling with H.S. steel or tungsten carbide midget mills; for micro-finishing and polishing. Use on wood, glass, rubber, plastics, or any metal including the hardest alloy steel.

DURABILITY. All metal housing, rigid PRECISE quill, lubricant-sealed micro-precision bearings. ¼ H.P. AC-DC motor (115 volts) is protected by replaceable fusetrons.

ATTACHABLE COOLFLEX SHAFT. (optional) Quickly attached for bench work and hand-tool applications. Same speeds, same precision quill as in PRECISE SUPER 40.

Milling hardened die with tungsten carbide mill in COOLFLEX ATTACHMENT.

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ELMES *builds*

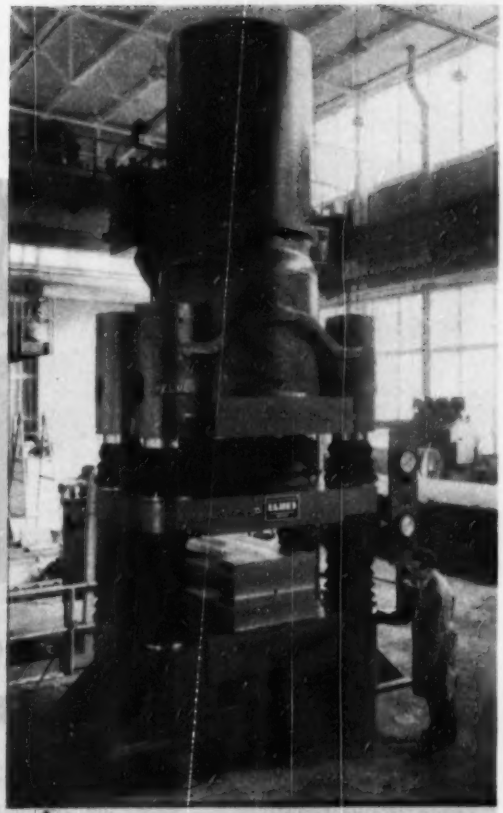
• a wider range of hydraulic press types and sizes

• with outstanding production economies

in NEW Ultra-Modern Plant

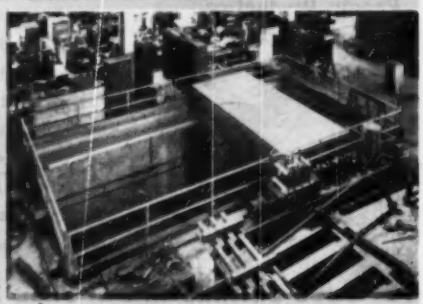
• In the large, modern plant shown below, equipped with the most advanced production facilities, Elmes is now building *much larger* presses and other hydraulic equipment in an *even wider range of types and sizes* than was possible before. And—with far greater economy. Now, more than ever, it will pay you to "Put Your Pressing Problems Up To Elmes."

You can't afford to keep outmoded machines on your payroll: they're too expensive—in low output, in high production and maintenance costs. Replacement with modern equipment is your BEST profit insurance. It will pay you to investigate the production potential of modern, high-efficiency Elmes Presses.



▲ This 2000-ton Elmes Abrasive Wheel Forming Press is one of the first large units produced in Elmes' new plant. The press is lever-controlled with two pressures available. Rugged construction assures minimum deflection.

▼ Aerial view of the new Elmes plant—one of the finest in the industry. The most modern precision production equipment and extensive working areas make possible the building of Elmes Hydraulic Presses in a greater variety of types and sizes, both standard and special designs.



▲ A view of the new Elmes assembly pit for erecting presses of unusual height. Sectional pit covers permit simultaneous erection of several normal-height presses having sub-floor assemblies.

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characters are acceptable and no awkward questions asked. But I always thought Ed a week-kneed sort of chap, afraid, almost of his own shadow; never able to face up to anything where any stand was necessary, either for a principle or when a little judgment was needed. Maybe he got Matson to promise to be a good boy!

"But there is a more serious side to the question than that. You could knock his damned head off if you catch him double-crossing you, but what about the effect of his association with the younger fry? Would you like your son to associate with men of the Matson type? Smithers, at the other end of the town, won't start a man if he hasn't got a clean sheet. They argue the best work can be expected from men with straight, clean minds and that in the long run, character and the best kind of skill go together. Also, they argue that to expect men of good character and superior skill to be associated with men of dubious conduct is to risk losing the cream in order to retain the dregs and froth.

"I have a boy for whom I want a start. Jones' place is the more handy but rather than put him where he may be influenced by men of the Matson type, I will try to get him in Smithers' works; his mind will be less liable to pollution there. He will associate with a better type of man; Jones' will have their Ed; their Matsons and it may be quite a lot of their tools, at any rate, some, and Matson's skill."

And Ed is neither his own, his firm's nor his brother's keeper.

J. E. Powell
Lindum, England

•

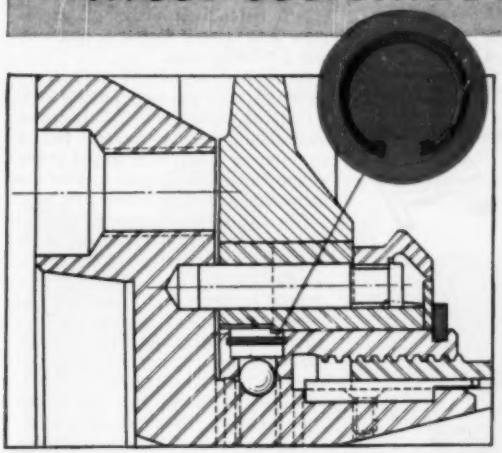
ALTERNATE DELEGATE

SURVIVAL of the fittest has been the method for keeping and promoting all sorts of help ever since organized machine-work started. In applying this rule any foreman is supposed to be qualified to judge his men; able to point out those a company should keep and discharging the others. Any man who has stayed with the same company, say five years, is considered a good man who might expect promotion any time and has probably been promoted before.

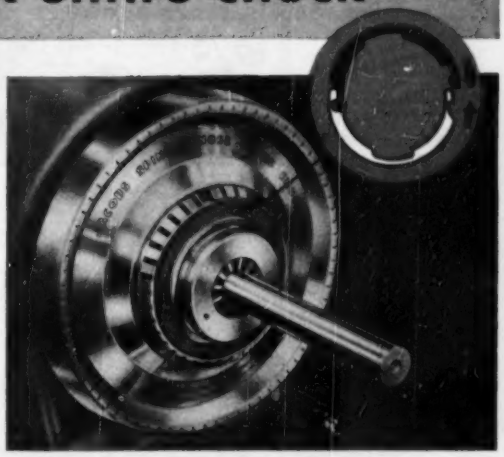
The superintendent is likewise supposed to be able to tell advantageously what foreman to keep and promote and state the names of those he does not think come up to his demands.

I wonder if in passing these judgments, proper consideration is taken

2 Waldes Truarc Rings Save Space ...cut costs...Lock entire chuck



INTERNAL RING: Used instead of a shoulder screw, Truarc internal ring #5000-37 locks disc over ball loading hole. Saves 1/8 inch in overall diameter. Eliminates tapping. Withstands machine vibration and vibration from impact device within chuck. Used with Truarc pliers, it facilitates assembly and disassembly.



INTERLOCKING RING: Used instead of a locknut, Truarc interlocking ring #5107-343 locks handwheel assembly securely on impact sleeve of Jacobs chuck. Saves 7/32 inch in overall length. Eliminates tapping. Chuck's top speed: 5000 RPM; Truarc ring is dynamically balanced to withstand 50,000 RPM's. Services easily with a screwdriver.

2 Waldes Truarc Retaining Rings secure the entire mechanism of new spindle nose lathe chuck for Jacobs Mfg. Co., Hartford, Conn. Truarc gives Jacobs a finer, more compact product, and at lower cost than possible with any other fastening device.

Wherever you use machined shoulders, nuts, bolts, snap rings, cotter pins, there's a Truarc Ring that does a better job of holding parts together.

Truarc Rings are precision engineered. Quick and easy to assemble, disassemble. Always circular to give a never-failing grip. They can be used over and over again.

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2 TRUARC RINGS GIVE 6 BIG ADVANTAGES

- Cut overall length 7/32 in.
- Cut overall diameter 1/8 in.
- Eliminate cost of tapping
- Withstand up to 50,000 RPM's, give a factor of assurance of 10
- Withstand machine vibration
- Facilitate assembly, disassembly

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AM-062

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Company_____

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City_____ Zone____ State_____ ★

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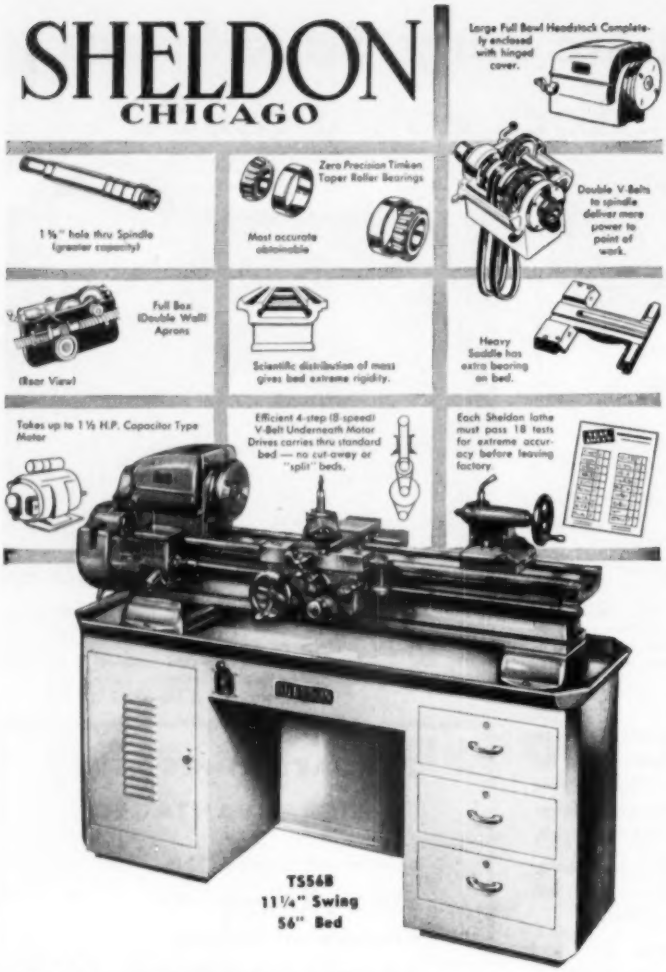
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Most accurate obtainable
Double V-Belts to spindle deliver more power to point of work.
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Increase your shop's earning power by replacing slow, cumbersome, old style equipment with batteries of these light, fast, modern tools.

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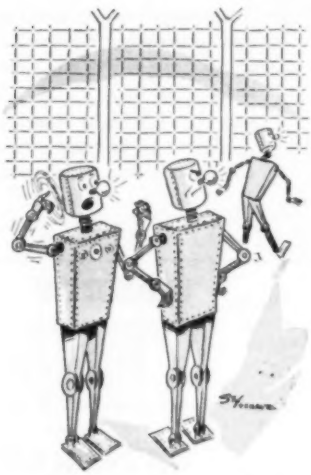
of each man's ability and behavior measured over a number of years, or whether it rests only on a temporary impulse of the judge. I have seen supervisors ruining many a man's future simply because he did not think this or that man was able to defend himself, or the supervisor felt himself forced to show he was a "strong" man.

As we have no unit of measure by which we may measure a man's ability I think anyone who has charge of men should be very careful before any step is taken that might make a man feel he is slipping or that the management is dissatisfied with him.

The supervisor who was able to hire and fire without a clinch used, at least up to a few years ago, to be considered the type of leader that should be promoted to higher and higher positions. I wish there was some way of figuring out how much good-will, experience and work has been lost by this typical dictator's method. Measured in money the sum would be tremendously large.

Most companies, especially the big ones, do not commit themselves to anything by which a man might expect to be promoted to a better job before that job is vacant. It is often a matter of supply and demand at the moment who is going to be promoted or discharged. At some places the Law of the Jungle still rules. How much better would it not be to line up worthy men and tell them if they work hard and attend to their duties properly they would have a chance to be promoted to this or that job.

A man might be very useful at one



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Threads machined with Gulf L. S. Cutting Base and Gulf Cut-Aid more than pass our 1,500 psi hydraulic test —the average is 3,000 psi."

These are typical of the results obtained with this effective combination in scores of modern machine shops. Gulf L.S. Cutting Base contains a high percentage of sulphurized fatty oil, which helps effectively to reduce friction and improve finish. Gulf Cut-Aid gives improved flushing action, adds to cooling properties, and helps increase penetration and wettability.

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You may specify and buy alloy steels for years without a slip-up—without getting the wrong specification—without a breakdown or accident.

But many men and machines handle your alloys before they come to you. That means many chances for error—for a mistake—possibly with serious consequences.

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The value of each step has been proven by the experience of other alloy users. And all of these steps are taken for you at no extra cost. So specify and buy Ryerson Certified Alloys. Shipment is immediate.

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particular job. If this is the case I do not think he is less useful in some other occupation some time later. It is better to move a good man about until he is promoted than keep him where he has been found to be efficient at some particular time. There is no reason why he should not be equally efficient on some other job. The main point is to make the man feel his efforts are being appreciated. If a man has learned his trade properly he is not liable to handle his job less efficiently a few months later, but if he is kept on other jobs for years, then, of course, he has lost many of the methods constituting that trade.

A. E. Fristedt
Stockholm-Angby, Sweden

•

NO AMBITIOUS MAN likes to "mark time," and Al appears to be one of the breed that likes to keep going—not content to wait for the man above to step down. While it may be smart management to have a good man ready for every good job, it is also smart management to realize that the good men often have different personality traits. A certain percentage will be content to plug along and wait years, if necessary, to attain their objective.

Fortunately for management, this type of individual constitutes the majority of what are definitely the key men of industry. Management is also blessed, or cursed with—depending on one's viewpoint—the men like Al whose personality is geared to a faster tempo, always on the lookout for bigger and better bottlenecks. Strangely enough, quite a few of these rare individuals are not particularly concerned about the material rewards that usually accrue from their efforts.

In Al's case, for example, the job he would like to tackle doesn't pay more than he is already receiving. To him there is an intangible satisfaction about such an assignment that money can't buy—it poses a challenge that he feels equipped to meet. Certainly, he is going to be much happier tackling a job that appeals to him, than going along day by day following a groove that might easily become a rut.

From management's viewpoint, it is admittedly difficult to place and please everybody, but a real effort should be made to see that every man's ability is recognized and used to the fullest extent. Sometimes a man who possesses drive and initiative waits in vain to have his talents recognized and seeks new pastures. Sometimes a slight increase in salary, or a friendly pat on the back is

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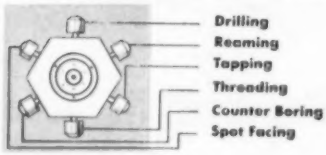
THE Burgmaster SIX SPINDLE TURRET TYPE AUTOMATIC INDEXING DRILLING and TAPPING MACHINE

GIVES YOU 6 MACHINES IN ONE!

Burgmaster A Universal Type Production Machine, features .....

* 8" STROKE
* PRE-SELECTIVE SPINDLE SPEEDS
* INDIVIDUAL PRECISION DEPTH STOPS
* 110 VOLT CONTROLS
* 2-SPEED MOTOR
* ADJUSTABLE FEED HANDLE
* 9¼" THROAT CLEARANCE
* 15" x 21" TABLE WORK SURFACE WITH T SLOTS



The Burgmaster enables one operator to do the work of two or three and get the job done faster, better. A variety of jobs can be handled without moving the work piece from the machine table. It is simple to set up, requires but 6 square feet of floor space and is powered by a single motor.

Burgmaster users will tell you that their Burgmaster is the most economical machine in their shop, and pays for itself in a short period.

Write today for detailed information.

BURG TOOL MANUFACTURING CO.
3743 DURANGO AVE., DEPT. AM-1 • LOS ANGELES 34, CALIF.

HERE'S Tool-flex
NEOPRENE MOUNTED FLOATING TOOL HOLDERS
Another Outstanding Product of
BURG TOOL MANUFACTURING CO.

SELF-CENTERING
(ELIMINATES COSTLY SET-UP)

FULL-FLOATING • POSITIVE DRIVE

OIL-RESISTANT NEOPRENE MOUNTING

REDUCES TOOL BREAKAGE

SIMPLE CONSTRUCTION
(ONLY FOUR MAIN PARTS)

Write for information... Dealer inquiries invited

BURG TOOL MANUFACTURING CO. Dept. AM-1,
3743 DURANGO AVE. • LOS ANGELES 34, CALIF.

sufficient to retain a man who is doing a good job, but has brains enough to know that he might do better outside.

In Al's case, it might be worthwhile to make him assistant general foreman, while retaining his services as head of the milling department. With a good subordinate, capable of carrying on the routine work of directing production on the milling machines, Al could take over some of the less onerous duties of the general foreman and fill in for the g.f. should he happen to be absent. This would take his mind off the liaison job, by directing his surplus energy and talents toward the wider field of operation that someday he will inherit when the general foreman steps up or steps out.

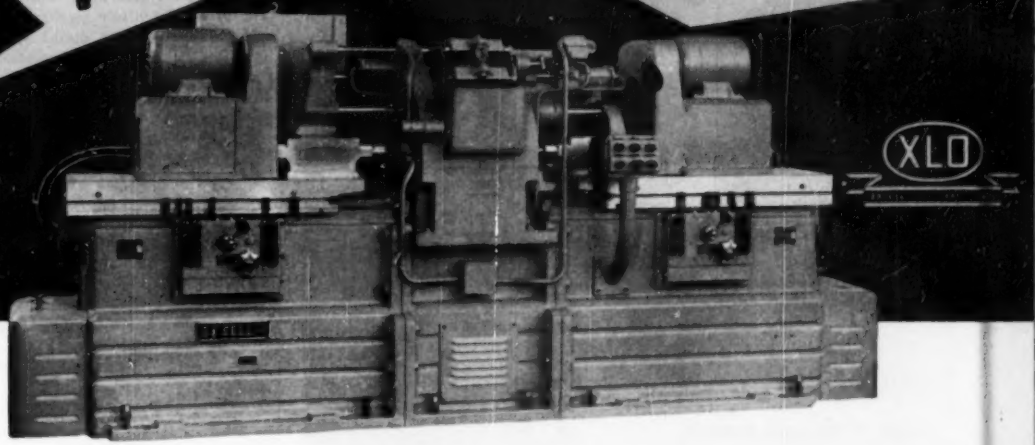
It is not enough for management to have a reservoir of good men, it must cultivate their good will in order to retain their loyalty and their services. The best way to do this is by getting as close to them as possible and encouraging them to talk frankly of their duties with the company, and the type of job they consider themselves best qualified to fill. Sometimes a man will volunteer the information that he has prepared himself by outside study for the job he has in mind. In turn, management is obligated to make it worthwhile for the exceptional man to stay with the company by rewarding him for his loyalty. No matter what form the reward may take, whether it be in the form of a bonus, salary increase, or a chance to visit a machine tool exposition at the company's expense, the recipient is bound to react favorably. Above all, let it be known that top management is always ready to discuss a man's future with the company in an open and above-board manner and there will be no room for misunderstanding. I think if Al went to the big boss and convinced him he was more valuable to the company in another job, he would do himself more good than by keeping his opinions to himself, or discussing them with friend Ed.

Robert S. Alexander
Greenville, R. I.

•

SURELY Al is displaying his lack of courage by becoming despondent at his first disappointment. That is not the spirit which caused Alexander the Great to sigh for more worlds to conquer and it is not clear that Al has really conquered one, yet. In the absence of production statistics as to what is the theoretical efficiency of the milling department, all that Al has done is to prove that he

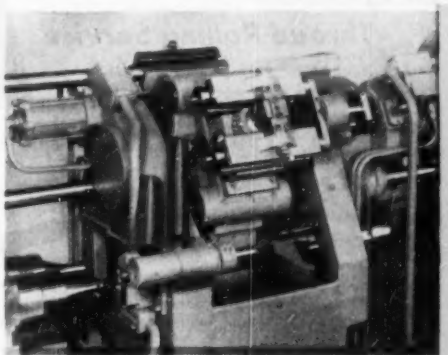
DOUBLE ACTION FOR DOUBLE PRODUCTION



EX-CELL-O TWO-WAY MACHINE BORES, CHAMFERS, AND FACES BOTH ENDS OF TUBULAR STEEL PARTS AT NET RATE OF 366 PIECES PER HOUR!

Ex-Cell-O Way Type Precision Boring Machines save time by machining parts from two or more directions at the same time. And relationship of the various operations to one another is exact because the accuracy is built into the machine—it does not depend on the accuracy of repeated locating and clamping.

The machine illustrated here has a trunnion type indexing fixture, machines both ends of two parts per cycle, ejects the finished work automatically. Have your Ex-Cell-O representative explain all the advantages of these machines to you, or write today to Ex-Cell-O in Detroit for further information.



View of the three-station indexing fixture. Parts are loaded in upper station, machined in lower station, automatically unclamped and ejected from rear station.

EX-CELL-O CORPORATION DETROIT 32 MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS
DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

Threads are Rolled easily on Metal Stampings

with REED

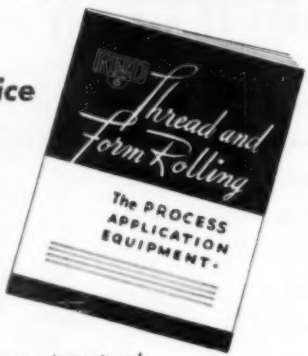
Cylindrical Die Thread Rollers

Use of thinner metals reduces material costs.

A Complete Thread Rolling Service

The efforts of our organization are devoted exclusively to the study and development of the thread rolling process and the design and manufacture of thread and form rolling dies, machinery, knurls, thread rolls and accessory equipment.

Write for our new 16-page Bulletin 5-2, giving complete information about the Thread and Form Rolling process and its application and equipment.



Send us specifications of your requirements and let us supply you with complete information.

REED ROLLED THREAD DIE CO.

Manufacturers of

THREAD ROLLING MACHINES AND DIES • KNURLS • THREAD ROLLS

Worcester 2, Massachusetts, U.S.A.

AM-017

was more successful than his predecessor, a position which is comparative but not determinate. Some other man tomorrow may come along and obtain even better results.

But even if this achievement of Al's, which seems to have made him feel that he is on top of the world, were absolute, does one swallow make a summer? And would the fact that Al had got more out of milling machines than did another man point at once to his capacity to hold down "that engineering liaison job"? One could imagine this job would call for tact and discrimination. Perhaps the two require the same qualities. But perhaps it was here that the Old Man hesitated; he could see the whole picture; Al, like a horse in blinkers, could see, only, straight ahead, an incomplete view.

Al may have all the qualifications for a bigger job but he will have to prove his worth in more than one direction to win his spurs. An old manager used to say that in making a wrong choice it was possible to fail both ways; lose a good workman and "gain" a poor foreman. Al would surely not wish to demonstrate the truth of this principle. Let him indicate that he is a big-mind man; little dogs yap and whine at things the big dog ignores; Al must be a big dog.

P. E. James
Lindum, England

•

DRESS UP OR DRESS DOWN!

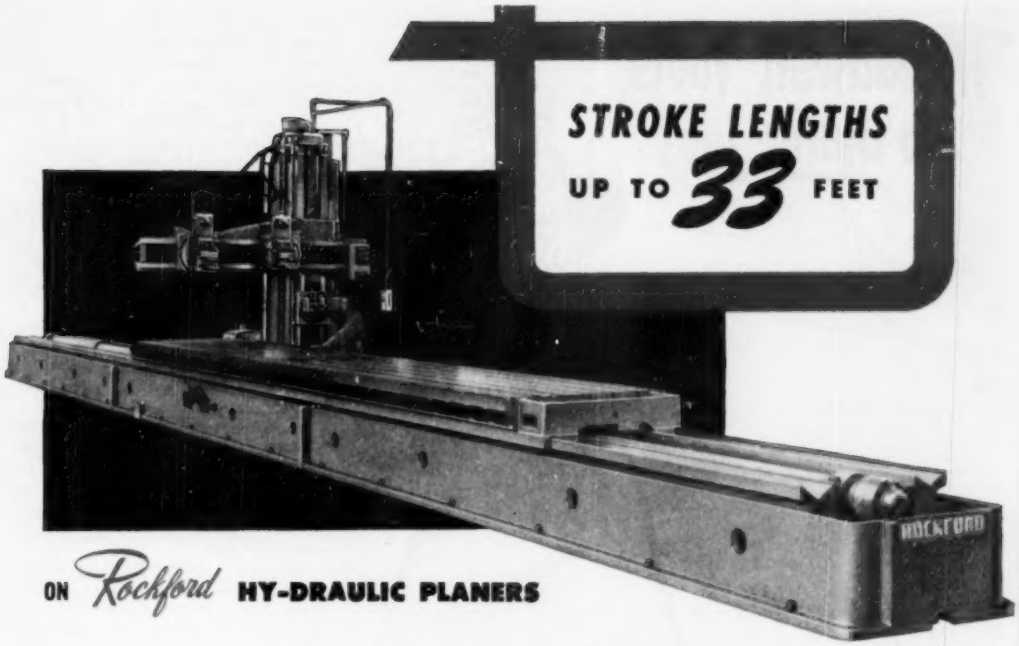
I JUST WONDER how long a sales manager would last if he changed his advertisements only when the bulletins on the boards were changed.

He probably would not get a chance to write his second set of ads. However the management allows a bulletin to stay on the board until it fades out and blows away.

If advertising in such a haphazard manner is not productive of results, why does the management expect the bulletin board to produce results? The bulletin board is a method of advertising and sometimes is more valuable than commercial advertising of the company's product.

To substitute the house organ for the bulletin board would be like advertising a new gear cutter or lathe in one of the women's magazines. The circulation might be greater than that of *A.M.* but the ratio of potential customers of the number of readers would be woefully small.

Dress up the bulletin board and place it in a good light where all can see it. Limit the notices to a stay of one week or so. Put up bulletins showing how production is going



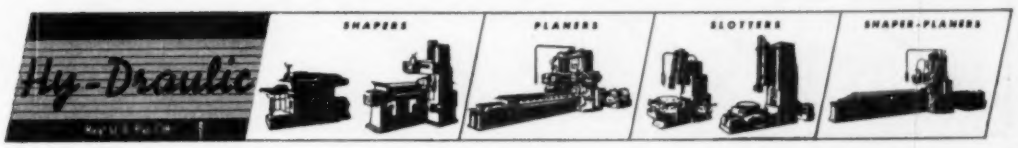
ON *Rockford* **HY-DRAULIC PLANERS**

Rockford
HY-DRAULIC DRIVE
Gives:

SMOOTH, EVEN CUTS
•
FINE FINISH
•
INFINITE
VARIABLE SPEEDS
•
FAST, EASY SET-UP
•
MORE METAL REMOVAL
PER HORSE-POWER

• Now you can obtain the many advantages of Rockford Hy-Draulic drive and feed in long planers with cutting strokes up to 33 feet in length, with speeds that are infinitely adjustable up to a maximum suitable for carbide tools. Return stroke speed may be set independent of the cutting stroke speeds . . . so that fast return stroke speed can be used to save time, regardless of what the cutting stroke speed may be. Basic design such as this, giving maximum control over varying production conditions, cuts operating and maintenance costs to the minimum. Write for complete information and specifications, contained in Bulletin 450B.

ROCKFORD MACHINE TOOL CO.
2500 KISHWAUKEE STREET ROCKFORD, ILLINOIS



Threadwell Tools do many jobs

they can do your tough ones

For the answer you've been looking for, call in your nearest Threadwell Distributor. You can get his name as well as complete information by mailing the coupon below.

THREADWELL TAP & DIE CO., Greenfield, Mass.

Send me free Bulletins checked below

Name _____

Position _____

Company _____

Street address _____

City _____ **Zone** ___ **State** _____

Threadwell

Taps ☐ **Dies** ☐ **Drills** ☐ **Counterbores** ☐ **Keyway Broaches** ☐ **Gages** ☐

and how it compared with last year, or similar information (the men are interested). Or a note that the company has a lot of second-hand lumber for sale at give away prices or that Bill Jones has a setting of duck eggs he wants to trade for an angora kitten or any such items that will pop up after the men see that the bulletin board is working. But don't let notices get too long. Keep them short and to the point.

Don't make the house organ a classified advertising section or a boiler plated pep talk sheet or even a political journal. If the men are live enough to be interested in a house organ they probably can find enough material to fill it.

Such important notices as those that affect plant operation or company policy should go on a small board reserved for that purpose at or near the clocks. The proposed company picnic should go on the general board.

One man should be responsible for the bulletin boards in the entire plant. Most plants have an old pensioner somewhere in the works who would appreciate keeping the boards in shape and removing the waste paper. Or, if there is no old pensioner one of the office girls (one who does not mind being whistled at) might be spared from her regular duties for the time it takes to post the notices. It does not take much time to keep up the boards once they have been brought into good shape. But if allowed to go to pot it takes a lot of time to get them back into shape.

A bulletin board reflects the company policy. Let it get dusty and fly specked and it indicates that the company is not interested so the men drop into an "I don't care" attitude toward the company. Keep the bulletin board up and the men naturally feel that the company is interested enough in them to let them know what is going on so the men have a better feeling toward the company.

Chas. O. Rankin
Ontario, Calif.

•

JUDGING by the number of bulletin boards needing "dressing up" that I have had the dubious pleasure of attending to, it's about time that management gave more attention to getting its boards "dressed up," and "dress down" the culprits responsible for falling down on the job of properly maintaining them.

There are a host of other things to remember if you want to make

Makes everyone's job easier!

PARKER-KALON

SIZE-MARKED

Socket Head Cap Screws

Tool crib bosses

like 'em because the Size-Mark speeds up sorting of left-over, mixed screws, without the bother of "miking" or gauging.

Assembly workers

welcome them because the Size-Mark speeds the job. Sizes are always issued correctly — there's no time wasted, no annoyance.

Apprentices

are all for them because the Size-Mark saves time, protects "green hands" from errors, helps them learn faster.

and that GEAR GRIP† makes 'em slip-proof!

† U. S. DESIGN PAT. NO. 126,409

Even when fingers are oily, the GEAR GRIP on P-K* Socket Head Cap Screws prevents slipping. When fingers can fly, the work flies!

Only Parker-Kalon offers the SIZE-MARK and GEAR GRIP. Take advantage of these exclusive features—watch your product's assembly costs go down, its sales appeal go up.

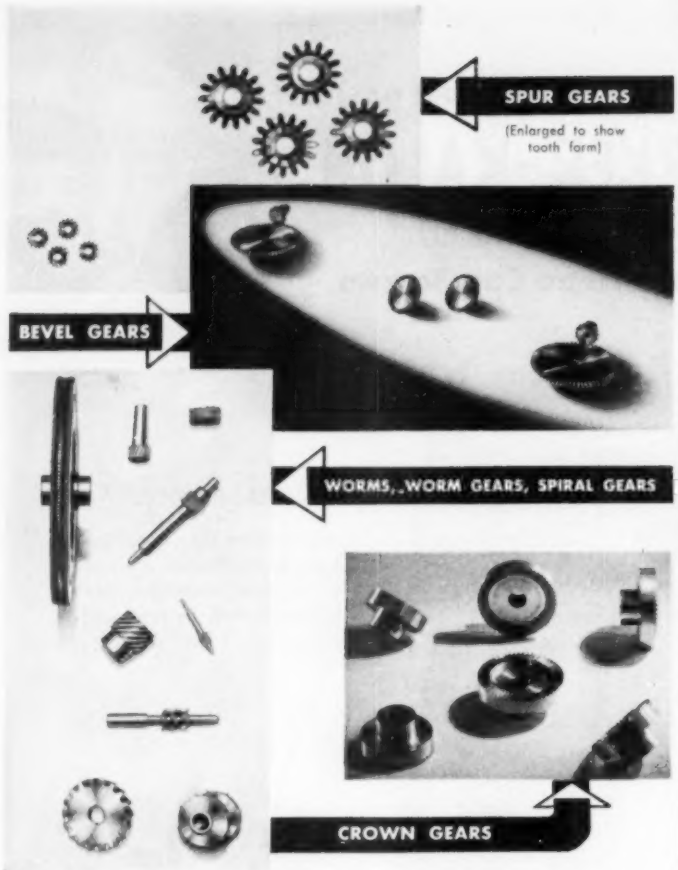
SEND FOR SAMPLES and Stock List. Simply address Parker-Kalon Corporation, 200 Varick St., New York 14, N. Y.

P-K **PARKER-KALON*** *cold-forged* **SOCKET SCREWS**

SIZE-MARKED SOCKET HEAD CAP SCREWS • GROUND THREAD SOCKET SET SCREWS
FLAT HEAD SOCKET CAP SCREWS • STRIPPER BOLTS • PIPE PLUGS • HEX KEYS

AVAILABLE EVERYWHERE THROUGH ACCREDITED DISTRIBUTORS

*REG. U. S. PAT. OFF.



HAMILTON No. 1 PRECISION GEAR HOBBER

(Capacity:—6" diameter of gear blank)

Install a Hamilton No. 1 Precision Gear Hobber and make your choice:—the same hourly production as formerly with far more precision, or the same precision as formerly with greatly increased production.

Ask for Bulletin H-1-49

A few **DEALERSHIPS** are still available.

THE Hamilton TOOL COMPANY

830 SO. NINTH STREET • HAMILTON • OHIO • U • S • A

this medium of employer-employee camaraderie hit on all cylinders. Here's some good advice on the subject for those who desire to revamp their employee communications setups:

1. Responsibility: It's important that one person should be delegated the responsibility for keeping your bulletin boards neat and up-to-date.

2. Accessibility: Put your bulletin boards in place where they can be seen and read conveniently. They should be near but not in congested areas. Your board should be at eye level. If it's too high or too low, much of its messages will be missed.

3. Physical appearance of bulletin boards is most important. First of all, they should be covered with glass. Second, they should be kept free from dust, excess thumb tacks and curling papers. And be sure to check the lighting.

4. Don't clutter up the board with too much material. Contents of each board should be readable in 2½ minutes.

5. Timing: Material should be changed at least every ten days, but a lot depends on the type of information you have.

6. Variety: This is the crux of the successful bulletin board technique. A mixture of company news and gossip, a photo or two; these are best medicine for an ailing board.

7. Writing: Keep the English simple, and the messages short.

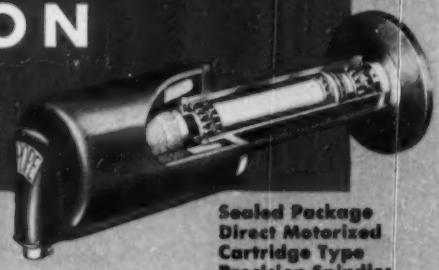
Harry Kaufman
Philadelphia, Pa.

•

IN THE LARGER SHOP, where a bulletin board has been found essential for keeping the men informed on changes in company rules and policy and other pertinent matters, the department clerk usually has the responsibility of looking after the board. If he is the type of individual who looks at this responsibility as just another added chore, the men are going to take only a cursory interest in it.

On the other hand, if the clerk takes a pride in his work, the bulletin board will be kept clean, up-to-date, and a distinct asset to shop morale—as it should be. In one shop of my acquaintance the board was placed near the drinking fountain but several feet to the right, where it would not cause the employees to "gang up" at the fountain itself, but would be readily visible as each man went to quench his thirst. Hung at eye level of the average man, the board was glass-inclosed, so that the notices were kept free of dust and grease. Also they were tamper-proof,

Specify POPE PRECISION SPINDLES



Sealed Package
Direct Motorized
Cartridge Type
Precision Spindles

Here's Why:

1. **POPE Spindles produce finer finishes.** They have the necessary massive construction and the radial and axial rigidity — *two* double-row, *super-precision*, cylindrical roller bearings and *two* separate ball thrust bearings.

2. **POPE Spindles increase production.** They have the power, the bearing capacity and the rigidity to carry a heavy cut. Rapid metal removal combined with superior final finish saves much operating time.

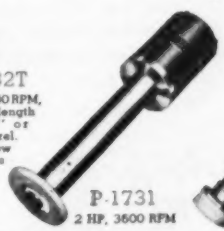
3. **POPE Spindles come in sizes to fit YOUR job.** They come in ½, 1, 2, 3, 5, 7½ and 10 HP and in 3600, 1800 or 1200 RPM to suit the work or the tool.

4. **POPE System of sealed-in lubrication** permits operation horizontally, vertically or at any angle — on boring mills, planers, millers, and other machine tools as well as on surface grinders.

5. **POPE Spindles require no maintenance costs** for lubrication or adjustments. This is just another bonus you get by specifying POPE Spindles.

P-34
½ HP, 3600 RPM

P-32T
1 HP, 3600 RPM, over-all length 25⅛", 3" or 3½" dia. barrel. Cut-away view (above) shows the permanently preloaded, permanently lubricated bearings.



P-1731
2 HP, 3600 RPM

P-771
5 HP, 3600 RPM

P-772
10 HP, 3600 RPM (Shown in bracket) Mounting brackets are available for all sizes.

When you want a Precision Spindle let us have your specifications and you'll receive a prompt reply including price and delivery. Ask for Data Sheet No. 12

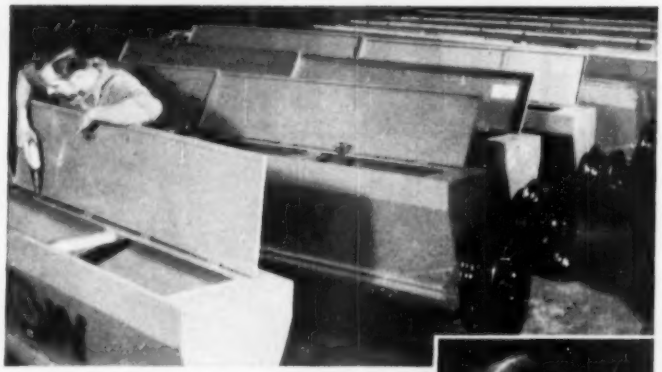
No. 70

POPE
TRADE MARK REG. U.S. PAT. OFF.

POPE MACHINERY CORPORATION
ESTABLISHED 1920
261 RIVER STREET • HAVERHILL, MASSACHUSETTS
BUILDERS OF PRECISION SPINDLES

5 cents a day

PAYS ALL MAINTENANCE COSTS



on this **BUCKEYE SCREWDRIVER**

In two full years of assembly line operation, driving more than a half-million screws, maintenance costs for this Buckeye screwdriver averaged just 5 cents a day . . . after 104 consecutive weeks of continuous service, screwdriver repair parts and labor costs totalled only $27.20.

This record, established at the Chicago plant of the Firecraft Corporation, manufacturers of agricultural equipment, is typical of Buckeye air tool applications in almost every type of industry. Lower tool maintenance costs, and greater productive output per tool, are benefits Buckeye Air Tools can offer you. Want proof? We'll gladly demonstrate in your own plant — without obligation — and let you be the judge.

NEW!

BUCKEYE AIR TOOLS CATALOG

Revised and enlarged, packed with helpful information for every user of air tools. Send for your copy today.

WATCH FOR THE NEW BUCKEYE C-LINE

Buckeye Tools
CORPORATION
DIVISION 15 • DAYTON 1, OHIO
MANUFACTURERS OF AIR AND ELECTRIC TOOLS

as the cover was locked in place, so that the well known urge of the shop "humorist" to make additions or comments was effectively restrained.

One side of the board was reserved exclusively for company notices. Then there was a center section devoted to safety, which usually featured a cartoon or one of J. R. Williams' "Out our Way" pictures that had a machine-shop flavor, clipped from the local newspaper. The other section of the board might be called personal and social, as the items were contributed by the employees themselves.

Articles lost and found, birth notices and other personal items culled from the local newspapers, in fact anything of interest to the shop force was sure to be featured on the bulletin board. If any of the boys had a transportation problem, such as getting to and from work, he told his troubles on the bulletin board. Or maybe another fellow had a housing problem, or surplus eggs or poultry to dispose of; all he had to do was talk to the shop clerk and soon a neatly typed notice would appear on the board. During the war years that particular department employed over 100 men on each of three shifts, at least 90% of them had occasion to use the services of the bulletin board at least once. I would say it was a definite contribution to shop morale. Certainly as a means of getting the men acquainted it had no equal. When it boiled down to a medium of exchange for goods and services it beat the average small town newspaper because there was no charge for its services!

Far from being obsolete, I think there is a definite place for the shop bulletin board if it is taken care of in the proper manner, that is, by a competent individual who has the interest of the company and the shop personnel at heart.

Robert S. Alexander
Greenville, R. I.

•

THE BULLETIN board is entitled to be given much thought as it can be made interesting and instructive to an extent that it will attract the attention of all.

For best results it should be placed in the foreman's department. The foreman should not edit all matters that are on the board, as others than the foreman may have matters of general interest that may be presented there; however, the foreman's O.K. should be given before they are placed on the board. Items of general interest are more than likely to come

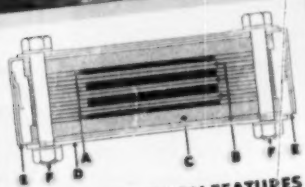
DESIGN LEADERSHIP IN THIS NEW Weatherproof FEED-IN DUCT

UNDERWRITERS LABORATORY APPROVED ***for Weatherproof Installations—Either Horizontal or Vertical Riser Runs.*** In addition to its complete steel enclosure, this new Weatherproof Duct has all the basic important internal design features of Square D's standard line of Feed-in Duct.

INCREASED EFFICIENCY. Temperature rise 50% lower than for other totally enclosed busses of equal copper cross-section and rating. Balanced voltage drop of only 1.8 volts per 100 feet.

MINIMUM SIZE. Exclusive design requires no ventilating openings for limiting temperature rise. Permits compact, rigid structure with high resistance to heavy electrical stresses.

EASILY INSTALLED and MAINTAINED. Standardized straight sections and fittings. See panel at right.



EXCLUSIVE DESIGN FEATURES

"One-split" bus **A** with halves positioned on either side of other two busses, permits close spacing and electrical symmetry important to reduction of both energy loss and voltage drop.

Solid ebonized asbestos insulating plates **B** and **C** which totally enclose bus, have great mechanical and high dielectric strength, conduct heat readily, are impervious to moisture and resistant to arc.

Surge clamps **D** and bolts **F** every 24" give structural and mechanical strength necessary to withstand 50,000 ampere shorts.

Steel housing **E** completes the weatherproof enclosure.

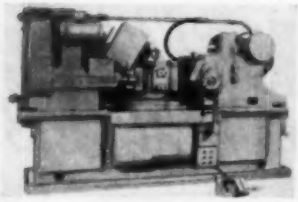
Write for Bulletin 5600. Address Square D Company, 6060 Rivard Street, Detroit 11, Michigan.

SQUARE D COMPANY

DETROIT · MILWAUKEE · LOS ANGELES

SQUARE D COMPANY CANADA LTD., TORONTO • SQUARE D de MEXICO, S.A., MEXICO CITY, D.F.

Here's what is meant by "1-2-3" in the GOSS & DELEEUW AUTOMATIC CHUCKING MACHINE



The outstanding advantage of this machine is ability to handle operations on one, two or three ends of a piece simultaneously or in sequence, *without changing set-up* or rehandling. It is the only standard machine that will do this.

"1-2-3" means ability to handle work requiring machining operations on one, two or three ends simultaneously or in sequence—a method exclusive with Goss & DeLeeuw and offered on this machine.

For complete details ask for illustrated bulletin. Send samples of your work for time and cost estimates.

GOSS & DELEEUW PRODUCT-QUALITY

GOSS and DELEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

from others outside of the department. A frequent change will keep interest and be of value if up-to-date material is used.

The boards should be in every department as it is not likely that any two departments would need to post the same material in all particulars. Care needs to be used in placing the boards in the best location where every one passes, and in a good light. Wording should be clear cut and of ample size that everyone can read easily. Sketches and pictures should be large enough and distinct that they may be easily understood by all.

Suggestions can often be made that will be of interest sufficient to make some changes each week or at least bi-weekly.

Safety measures and accident prevention should have a prominent position.

John Mark May
Watervliet, N. Y.

•

BULLETIN BOARDS certainly have their place in the industrial world today. Why should such a medium be lost when its effectiveness is probably greater than any other method that can be employed to keep people informed and re-informed on the same subject?

How many times have you listened to an announcement regarding some details of a problem and then after several hours begun to wonder just what was said? So it is with industrial announcements. Workers, as a rule, do not pay the strictest attention to announcements over the speaker systems because usually they are not plain enough to be readily understandable.

So after an announcement, the workers frequently will get together and try to figure out exactly what might have been said. Usually the interpretation is not accurate nor is it oftentimes what the management would wish it to be. The worker, therefore, has placed his own ideas into the message. This sometimes results in bad feelings between management, supervision and labor.

The effectiveness of bulletin boards rests in the constant changing of eye-catching material. The greatest weaknsss to most boards today is the tendency to leave things always the same.

How can you accomplish this? Well, it is not difficult and does not cost very much to do. First, be sure that your bulletin boards are modern and newly painted. Have a board with a locked glass front. Remember this is not to become a catch-all and,

5=15

THE NEW ROTOR "MULTI-POWER" CHIPPERS

5 "REGULARS"... 5 "SUPER-SPEEDS"... 5 "SUPER-SOCKS"
—ALL FROM 5 BASIC MODELS

SEE HOW YOU SAVE

with the versatile New Rotor Chippers

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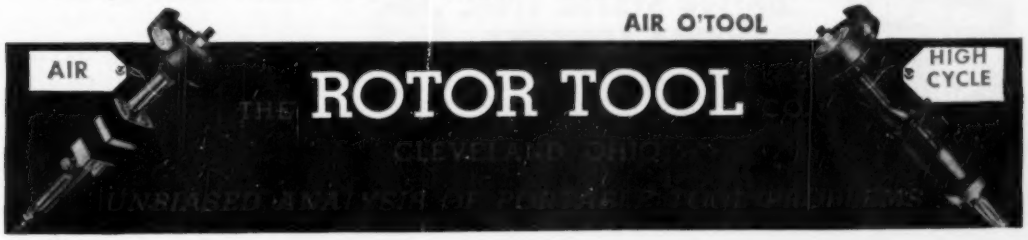

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UNITED STATES STEEL

therefore, the size should be kept as small as possible but large enough so that there will be no crowding of items.

Be sure there isn't a lot of machine traffic along the aisle that the board is placed. Frequently today in modern plants the boards are being placed in rest rooms or lounges of the employees. Other are being placed near entrances or clock stations. Boards placed around drinking fountains should be held to a minimum. Such placement tends to encourage loafing and today this should never be the practice.

Who should look after these bulletin boards? Most companies today have in their personnel department a person who can spend at least one or two days every two weeks to change over the boards. It should be stressed that this person has an important job and that it means much to the company.

Charles D. Townsend
Fort Wayne, Ind.

•

THE MAJORITY of bulletin boards generally are used for the display of most anything but for the original purposes intended—safety bulletins, any changes in working schedules, vacation notices, or any communication at all that the employer wished to bring to the notice of all employees.

Quite recently, in a very large plant, I saw several bulletin boards with notices like "Furnished Room," "Bill Smith wants two riders from Big Town," "Board for two young men with widow," plus a few pictures of glamour girls and all the trimmings, with and without. It was apparent from their generally dilapidated appearance that the notices had been there for a long time.

I don't believe that a foreman should have to bother his head about bulletin boards at all, as his job is production. These should be the personnel office job. The boards, themselves, I believe are of more value if they are placed right at the front entrance of the plant in a position where they catch everybody's eye.

I have been in plants where the loudspeaker method has been used to bring to attention of employees important decisions on various matters, but I don't believe that they are as effective as the poster on the bulletin board, for it is common to hear some employee say, "I didn't hear all that was said."

Now the attitude of all employers, who are up to date, believe that vacations for employees with pay is good investment and just as bene-

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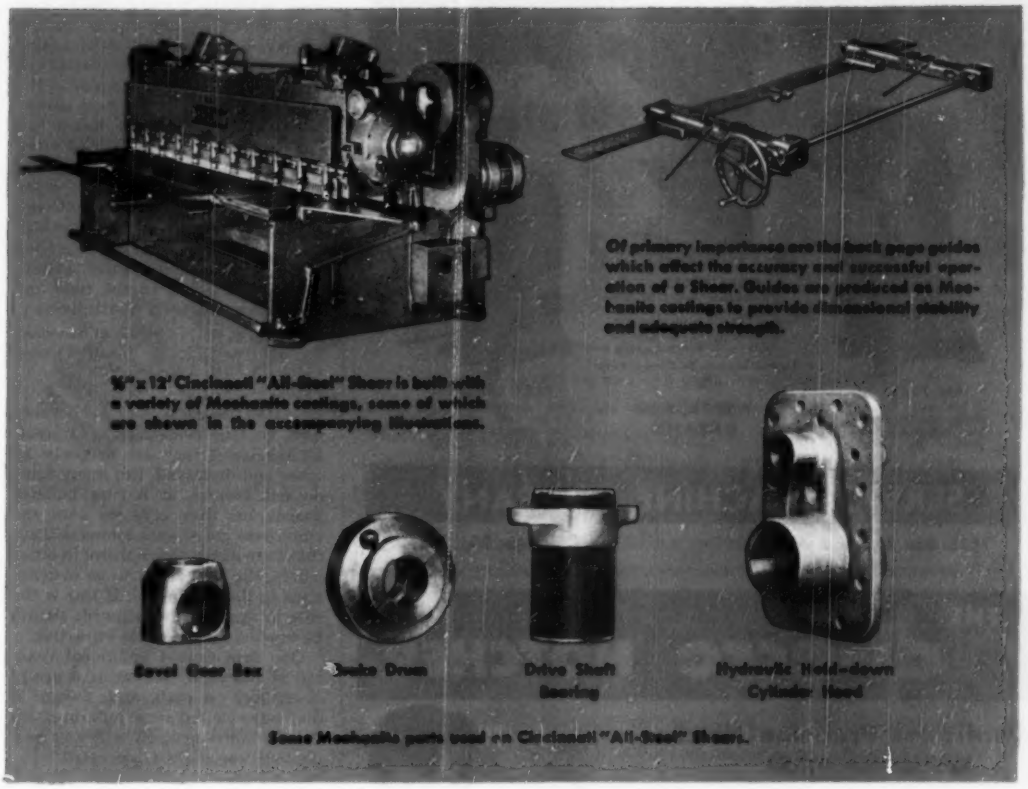
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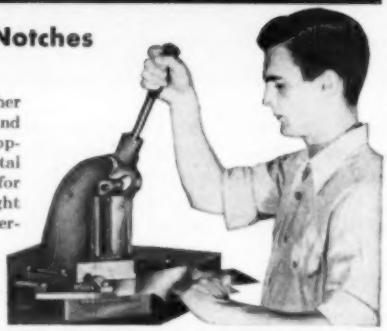

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O'NEIL-IRWIN MFG. CO.

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ficial to more production as a costly new production machine.

Truly the average workman has come a long way towards a better life through the years, and you know that when the employees see the vacation period posted on the bulletin board informing them that those works will be closed for the holiday, they must get quite a kick out of the fact that their wages will be paid as usual, particularly the older employee, for whom in earlier days vacations generally meant just staying around the house and often in the local saloon. Now they can plan for a complete change, enjoy themselves along with wife and family and go back to work all the better for the change with the feeling that things are generally getting brighter for them all the time and thus makes life truly worth living.

Arthur Silvester
Niantic, Conn.

•

BULLETIN BOARDS? Yes sir, every time. Bulletin boards can be of greatest service if they are properly located and displayed. But many firms do not believe in having bulletin boards for they consider that the employees get so accustomed to them that they never notice them; in other words, the boards get to be monotonous to the employees. If this is the case in any plant, the boards should be dressed up and made attractive.

One firm caused additional reading of boards by mounting a pretty cover girl on each, and, though it may have caused some loitering, this built a spirit of good will and production was slightly increased.

It is necessary that bulletin boards be kept in clean and attractive condition; that the bulletins, themselves, be interesting and instructive, and, they should be changed from time to time, say, every week.

If there are many departments in the plant, bulletins from one board may be transferred to another in a division remote from the first. Especially is this true where there are several entrance gates for employees and the bulletins are posted near the time clocks.

A bulletin board should never be placed near industrial tracks, paths of traveling trolleys or in other locations where men might be hurt by any of the types of industrial equipment used in modern shops.

Now, who is going to keep these boards in good condition and properly "decorated?" In one large plant, this is done by the safety engineer. In another, a man from the personnel department posts the bulletins

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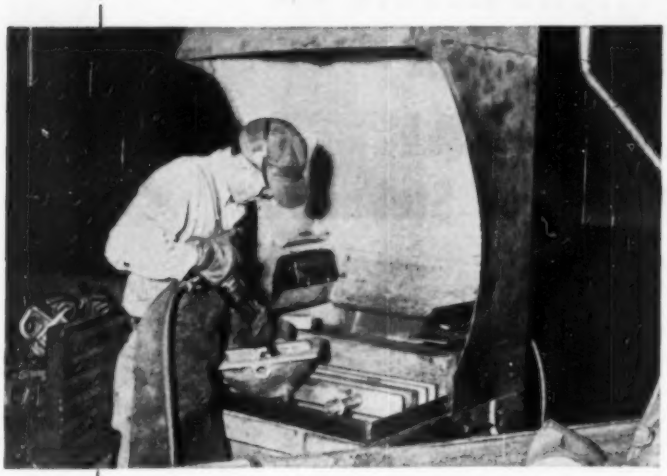

THEY don't "let the chips (and dust) fall where they may" in this foundry. Pictured here is a modern down-draft chipping booth which is served by an AAF Type D Roto-Clone.* Chips and dust are drawn off as fast as they are generated. Worker comfort is vastly improved and he has a clear view of the job at all times.

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You don't have to rearrange and disrupt your grinding operations to take advantage of Roto-Clone dust control. The Type D may be installed as a central type with main dust and branch connections or as an individual unit serving a single dust-producing operation. For complete information, call your local AAF representative or write direct to

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AMERICAN AIR FILTER COMPANY, INC.
207 Central Avenue, Louisville 8, Ky.
In Canada: Darling Bros., Ltd., Montreal, P. Q.

AAF
ROTO-CLONE®
DUST CONTROL EQUIPMENT

and also acts as the safety engineer.

No matter who takes care of the boards, they are a necessity in this day and age and they can be made to pay dividends which do not show upon the books.

F. H. Stebbins
Worcester, N. Y.

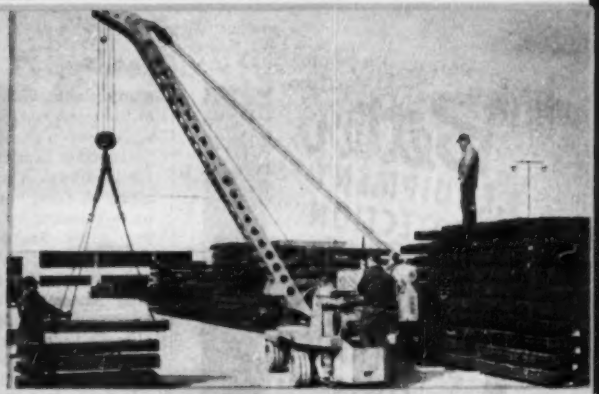
•

THE QUESTION of bulletin boards and their usefulness is by no means a new one. My grandfather told me that 45 years ago his shop had the same bulletin board problem; that is, the boards were dirty, out of date and unread. It has been my observation that the bulletin board is still the most effective and inexpensive method of conveying information to the worker provided the bulletin board is properly kept up. The board has more effect than passing out copies of a bulletin to each worker because the worker either loses the copy or reads it once and throws it away, promptly forgetting its contents. If a notice is on a well kept or readily accessible bulletin board, it is constantly before the worker's eyes and the repetition of seeing it makes the worker more conscious of its presence and its contents.

One of the best places a bulletin board can be located is near the water cooler. The majority of workers go to this oasis at least once a day and because of the line usually waiting for a drink each individual usually does not tarry too long in front of the board. With the repetition of seeing the notices he soon is aware of their presence.

I am not in favor of placing boards near time clocks as is done in so

". . . and this one is my new boy friend . . . here's Uncle Harry . . . !"



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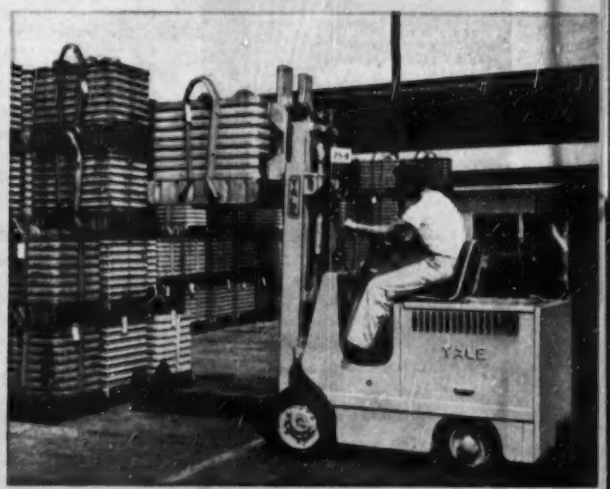

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many plants. When a worker punches the clock he usually does not have time to even glance at the notice for he is either late, in a hurry to go, or the line behind him is pushing him along at such a pace that coherent understanding of a notice is almost impossible. Should several workers insist on reading the notices when punching out the traffic problem created is terrific, jamming corridors to the point of making them impassable at times.

The best type of board in my estimation is one with a glass cover that can be locked. This serves two important purposes: First it keeps the notices flat, clean and untorn, and secondly, it keeps unauthorized material such as obscene poetry, cartoons, stories, and pictures from being placed on the board.

Ye Bulletin Board Editor should make sure that all notices are clearly printed or typed and placed so that they do not overlap. The editor should dress up the board, and I find that bits of humor, trite sayings (not too trite) and other material helps a lot. As a real interest-arousing feature try posting notices of departmental births, marriages, and deaths.

The editor should never forget with all the dressing that the prime purpose of the board is to convey to the worker information the company wants the worker to know about. The editor should never neglect the company notices to favor some choice humor. Common sense will eliminate gossip and other personnel friction producing items.

The bulletin board has fallen for the most part into obscurity but this valuable means of communication can be revived with a little effort. In plants that have tried these streamlined methods the result has been most gratifying.

William B. Harnden
Dorchester, Mass.

•

DEFINITELY, the bulletin board is not an obsolete item in any place of business. A board that is properly handled and cared for can do much in the way of bringing to light many items of interest to all. Not only should this board be used for company business and notices, but a section should be reserved for the employees. In this private section could be listed items for sale by the individuals and notices that they might care to display. Some say that this would clutter up the shop board. I say no. If the men are allowed to have a part of the display they will take more interest in it and will also gaze upon the notices that have been placed there for their consumption. How to get the men interested in the board? Can you think of a better way than this?

I have also found it true in instances of this kind that a schedule among the men, say two weeks at a time, to care for the listings brings out some special ideas of decoration and interest. This method doesn't take too much time off from work and it instills in the workers a certain amount of pride in the decorations they have made. Not the frilly type you see in store windows, but in keeping with the present theme of living. To bring about greater interest in the bulletin board, you can even hold a contest and make some type of small reward for the one voted the most interesting and striking.

A good spot to locate this valuable piece of information would be someplace near the gang's meeting-spot for lunch. There is no place that I know of in a shop that gives ideas, etc., the going over that the noon bull sessions do. With notices, posters and the like on hand, they would be sure to catch the eye of someone and the chatter would be on. You can't choke notices down the throats of your employees. They just don't like that kind of medicine and as soon as they sense the forcing of an issue they steer clear of the undertaking. If they are given a chance to feel their way around the subect and express their views pro and con on memos from the office and all of the other listings, a certain amount of the information sticks to them.

Most of the men I know like to work and live in clean surroundings and with a project of this type I have never found it necessary to ask that the man in charge for the period clean up his project. There is a certain amount of good humor that will certainly creep into existence with this idea. Should it be outlawed? Heck no! We really need more humor in the world today and anything that can get a laugh out of just one fellow is a tendency toward better relations with your men. We even had a pin up section where the men in charge could display their favorite pin-ups for their period fo overseeing. Believe me, some of them were pips and enjoyed by all. We even had the office staff out looking over the shop items to see if they could gather a bit of news on the side.

Make the shop an example of cooperation and the men will soon follow suit. They like to feel that they are part of things and this is

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just another little method of giving them a say so in the affairs that they put so much of their lifetime into.

Jack Bell
Bakersfield, Calif.

•

ARE PROMISES MADE TO BE BROKEN?

No one knows what a day may bring forth, nor even an hour. Situations may arise at any time that are so compelling that a person may feel obliged to make changes that had never been dreamed of before.

Most of us have family ties affecting us that must be considered for our progress and welfare, therefore making it not only risky but actually dangerous to pledge ourselves unreservedly for the future.

No one should pledge themselves unreservably, however if asked by his employer to do so he should be willing to promise loyalty and a willingness to stay onto the job for a reasonable time and do anything possible to teach others and in every way that he can make the change to cause as little confusion as possible.

I would consider it unsafe and unreasonable on the part of either employer or employee to make a hard and fast contract to hold under any and all conditions that might arise.

To have arrangements satisfactory to both parties they should be such as are agreeable to both parties or both parties should work a plan to that end. However, in a case where a promise has been made to remain on a job it should be regarded just as binding as a written and signed contract.

Abel Blakeman
Watervliet, N. Y.

•

Of course not. But changing one's job is one of the privileges of democracy. Any restraint on that principle would challenge its value. However, as this topic is an economic one it does not include any privileges at all. The world's work would not be done if everybody really had a chance to choose his place of employment. But it is not worth while chinning the curb for one or two men as Ed seems to be doing.

On the other hand, if the help's general trend in any shop is to work only a few days there must be some particular reason for not staying. If working conditions and wages are not what they should be, com-

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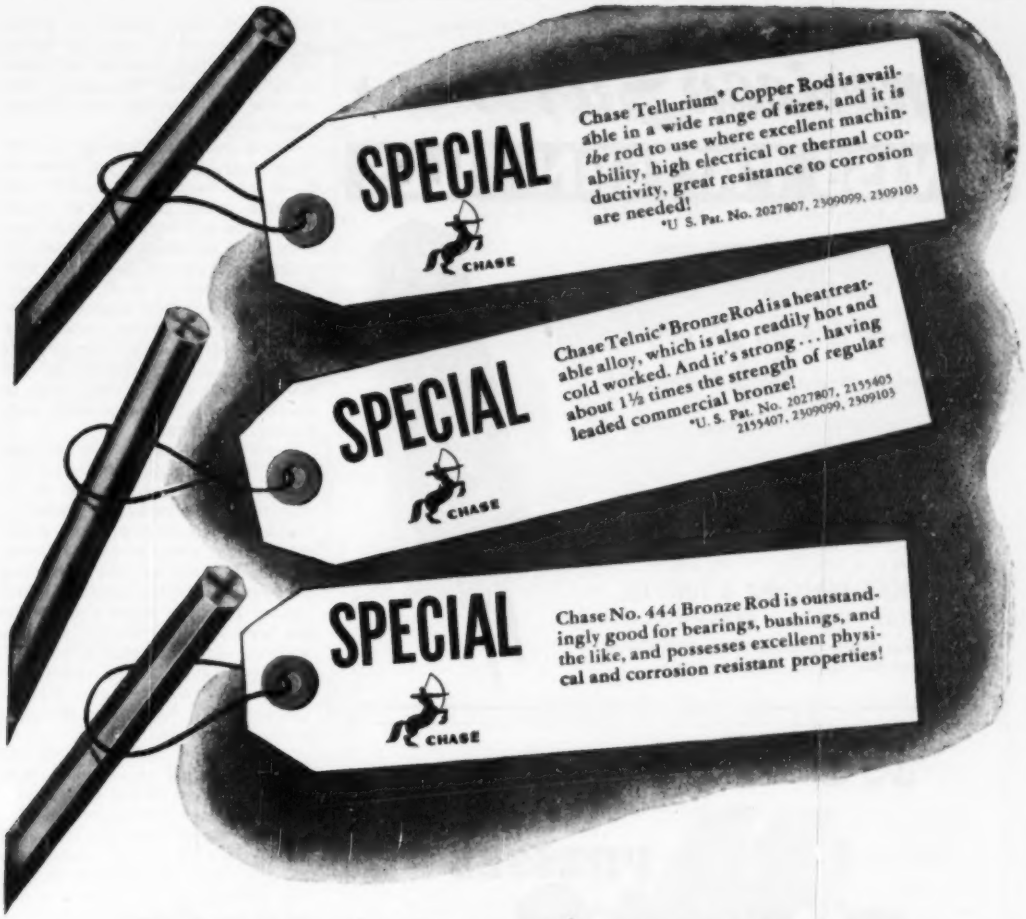
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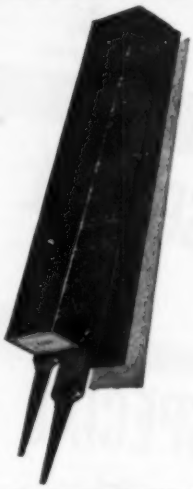

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pared with other places of work, promises are of no value in keeping those hired. And in our time of labor shortage one must also consider the personal attitude towards each man.

Young men are often restless because they do not know what to do to gain headway. Here Ed's experience might be of great value. If he could tell such applicants they have just as much chance at his place as anywhere else, and that he would try to give them permanent jobs if they attend to their duties, it seems to me unnecessary to extract promises of any kind. If he cannot do that he should not blame young men if they move to another plant where perhaps such favors are common.

Some of the older men moving about are probably drifters. But if an employer looks out he might find men of outstanding value in that crowd in spite of previous movements from place to place. Clever, experienced men will not stay unless they get an opportunity to show their ability. I do not think a man who has been a certain number of years with the same firm should have the first opportunity to the better jobs in that firm. Why not give the dissatisfied man a chance, too? He might be the better man.

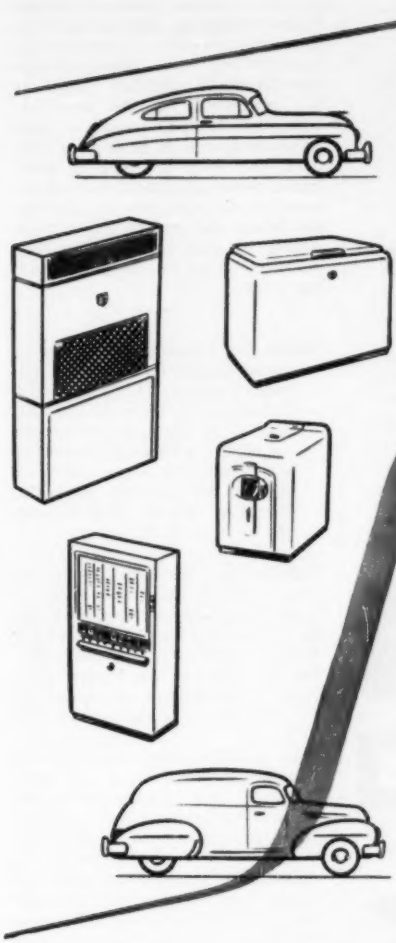
A man that has been with the same firm many years might have done so because he has been unable to get a better job somewhere else. Among restless men, on the other hand, there might be some very good workers who would only be too glad to get a job that would satisfy their ambition and stay rather than moving to another place of work.

A. E. Fristedt
Stockholm, Sweden

NEW BOOKS

GRINDING PRACTICE (3RD EDITION)—*By Fred H. Colvin, editor emeritus,* AMERICAN MACHINIST, *and Frank A. Stanley, formerly editor, Western Machinery and Steel World. Published by The McGraw-Hill Book Co., 330 W. 42nd St., New York 18, N. Y. 419 pages. Price $3.75.*

The third edition of this basic text on grinding machines and abrasive wheels includes standards on the main capacity dimensions for cylindrical grinding machines, the new safety code for grinding wheels, and



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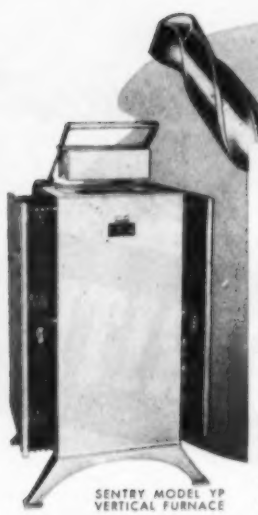

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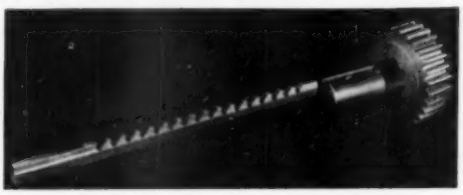

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the new method of marking grinding wheels which has been adopted by the Standardization Committee of the Grinding Wheel Manufacturers Association. In addition, much of the information in the book has been rearranged to provide a more logical sequence. As in previous editions, the book is profusely illustrated, shows equipment and tooling, explains the principles of grinding, and brings out important points on setting up and operating grinding machines on the full range of grinding work.

•

STRESS AND STRENGTH OF MANUFACTURED PARTS—*By C. Lipson, consulting engineer; G. C. Noll, project engineer, Thew Shovel Co.; and L. S. Clock, asst. professor of applied mechanics, University of Detroit. 259 pages. Published by the McGraw-Hill Book Co., 330 West 42nd St., New York 18, N. Y. Price $4.50.*

Engineering problems involving stress, strength and prevention of failures of parts and assemblies may be divided into these parts: (1) sufficient strength for anticipated service, (2) comparison of designs, materials and production processes, and (3) why did a service or test part fail?

To aid designers, engineers and metallurgists in solving such problems, the authors have produced a handbook-typebook very heavily illustrated with charts solving equations for engineering formulas. The material is arranged in logical sequence but does not require an understanding of preceding material, as is common with text books. Hence, a solution to a specific problem is much more readily found than is usually the case.

•

PRACTICAL IDEAS FOR MACHINIST—*By H. E. Linsley, Associate Edtior, AMERICAN MACHINIST. Published by McGraw-Hill Book Co., 330 W 42nd St., New York 18, N. Y. N. Y. 254 pages. Price $4.50*

Nearly 500 machine-shop ideas for cutting costs, saving time, substituting tools, and handling unusual jobs are edited from the pages of the Practical Ideas department of AMERICAN MACHINIST for the last ten years. Main chapters cover ideas on drilling, grinding, inspection, turning, layout, milling, planing, punch-pressing, maintenance, and welding.

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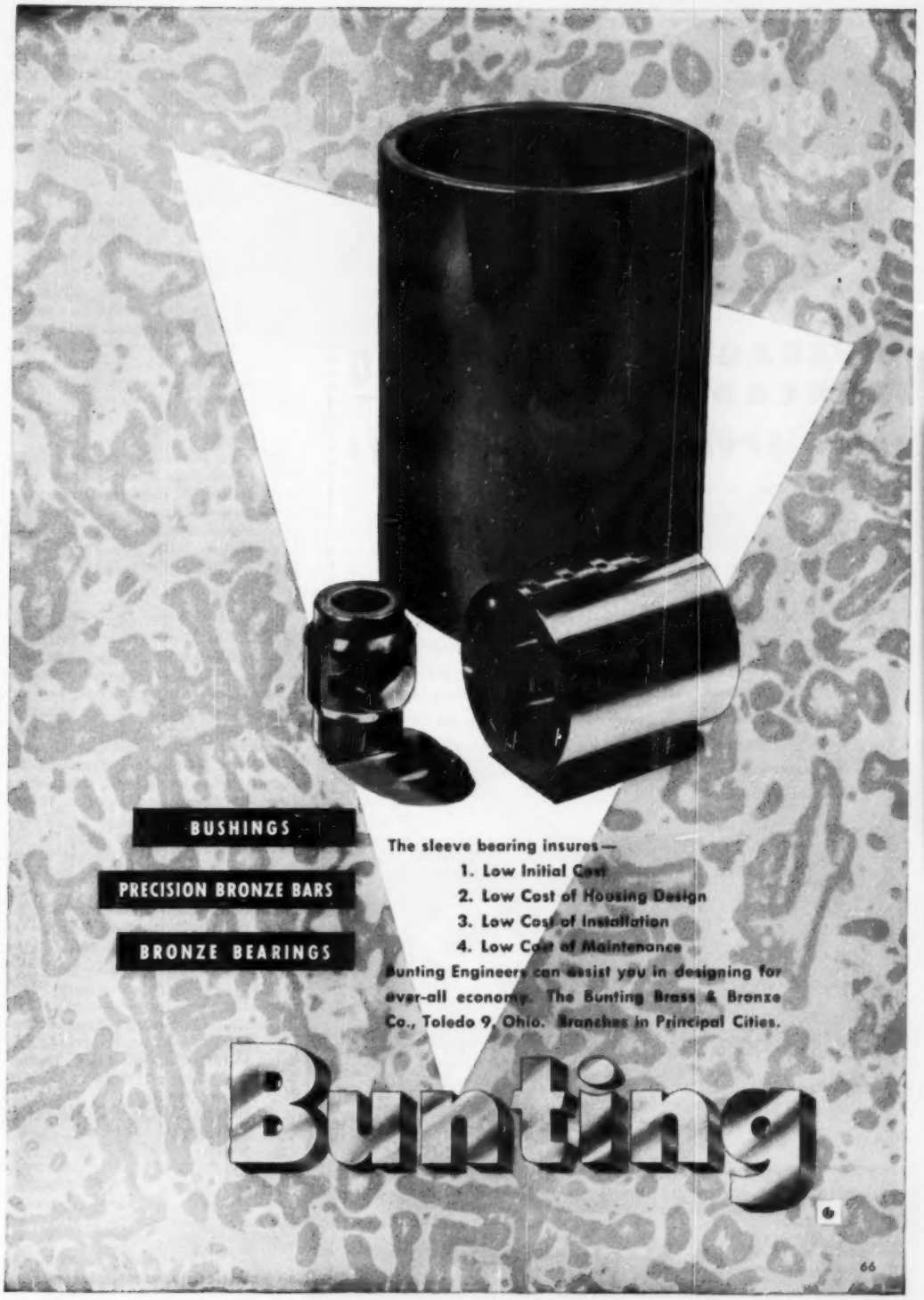
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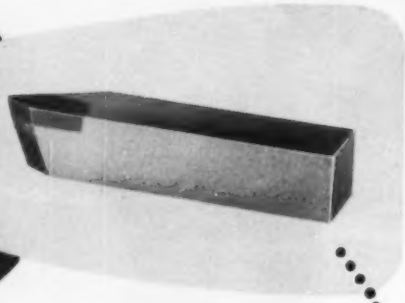

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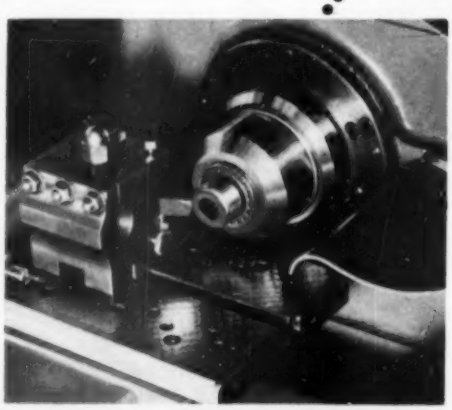

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derstandable by anyone familiar with shop work. Illustrations are entirely line drawings, and show the important parts of all tools, machines, and special fittings.

The selection of material was based on picking ideas that are not too specialized, so most items can be applied in any shop, large or small. Many ideas are explanations of how to make one machine or tool do the work of another, or how to get more than the normal capacity from standard shop equipment.

An interesting feature of the book is chapter titles at the bottom of each page with the page number in large type. A complete index provides cross-reference to all material, which can be found by looking for the type of equipment or the kind of operation involved.

•

MACHINE TOOLS FOR ENGINEERS—*By Charles R. Hine, assistant professor of manufacturing processes, Rensselaer Polytechnic Institute. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y. 355 pages, Price $3.50.*

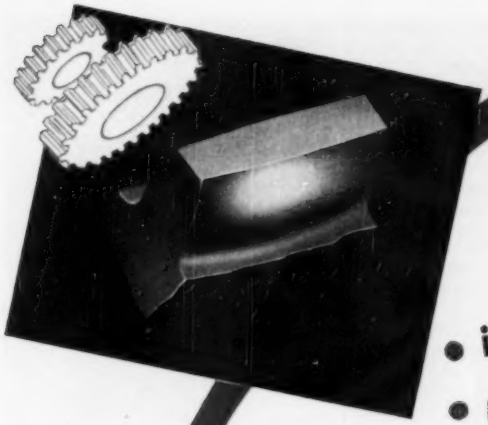
Intended for the engineering student, this book gives a brief review of each of the principal machine tools. The different types in each class are considered, and information given as to the nature of the operations which can be performed on them. Methods of work and tool holding are discussed, together with some basic information on the design and function of the cutting tools.

As an introductory work to acquaint the student with the fundamentals of machine tools and production processes, the book is excellent, but it is not intended for the practical man who may be interested in developing skill in the operation of machines.

•

WELDING DICTIONARY—FRENCH, GERMAN, SPANISH, ENGLISH—*Compiled and edited by R. N. Thompson, editor of "Welding," and G. Heim. Published by The Louis Cassier Co., Ltd., and distributed by Iliffe & Sons, Ltd., Dorset House, Stamford St., London, S.E. 1. 234 pages. 7½x5. Price $4.75. (Sold in U.S. by British Books Centre, 122 East 55th St., New York, N. Y.)*

One of the most useful books for the welding engineer who has occasion to deal with foreign countries, and



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an invaluable aid to the technical translator, this book contains material not to be found in other standard dictionaries. The development of welding has given rise to a host of new words and phrases, many of which have entirely specialized meanings and cannot be translated literally. This gives rise to considerable difficulty, even for those who have an average knowledge of a foreign language. With the aid of this book, however, foreign technical publications may be readily understood.

In addition to terms specifically related to welding, many other electrical and mechanical engineering, and metallurgical terms are included. the dictionary is divided into four parts, the English being treated as a key glossary with equivalents in the other three languages. English and metric conversion tables are included.

•

INDUSTRIAL INSPECTION METHODS. *By Leon C. Michelon. Revised Edition. 566 pages. Published by Harper & Brothers, 49 East 33rd St., New York, N. Y. Price, $6.*

Less than 10 years ago, inspection was frequently a function which received a certain degree of lip service but not its proper importance in the manufacturing scheme of things.

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The Michelon book does an excellent job of reviewing the basic concepts of industrial inspection so that the reader gains a basic philosophy of the subject and not merely some familiarity with inspection methods and devices. Following this are excellent descriptions and illustrations of a great variety of modern inspection devices, showing their use, adjustment and repair. Non-destructive testing methods, magnetic-particle inspection, radiography, etc., are included. Surface inspection is adequately treated. An extensive bibliography and list of manufacturers' bulletins on inspection should serve those whose needs are more extensive than the subject matter covered.

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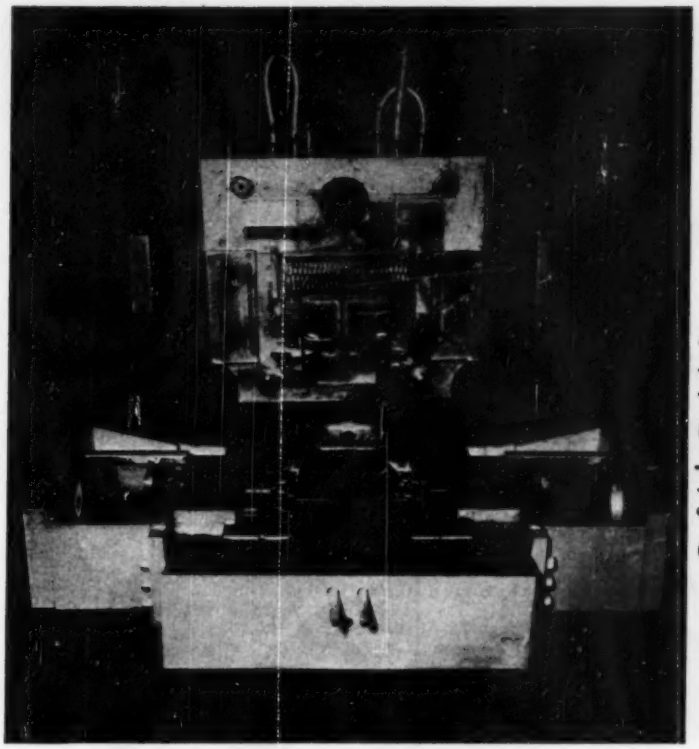

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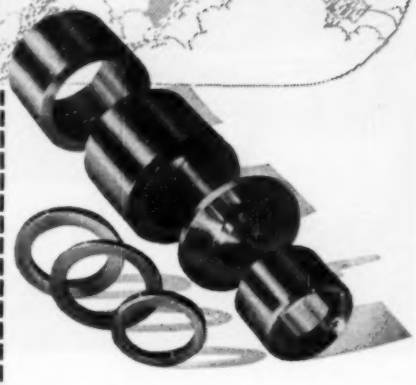

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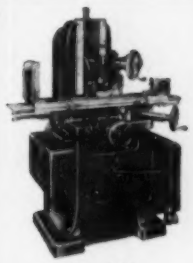

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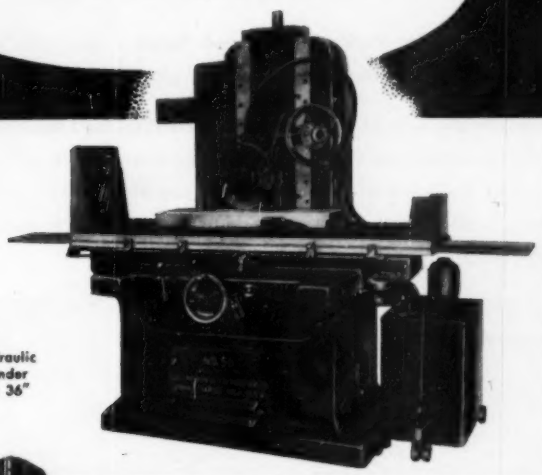

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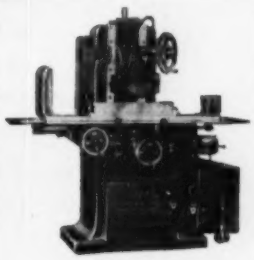

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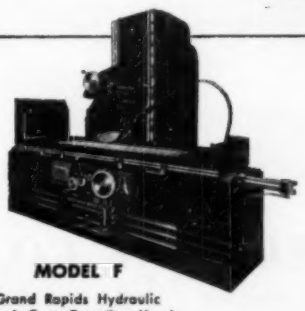

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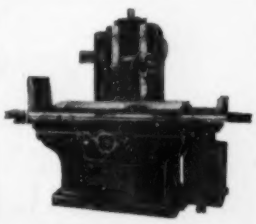

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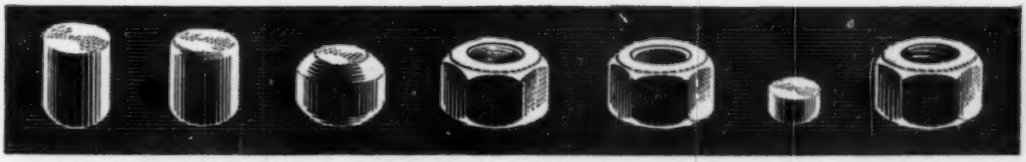
PITTSBURGH TOOL STEEL WIRE CO.

Since 1902 . . . manufacturers of cold finished fine steels and drill rods, including renowned Warplis drill rod rounds.

MONACA, PA.



For Minimum Rejects

FROM first to last, nuts formed from Youngstown Scrapless Nut Quality Wire stand strict inspection--by magnetic particle or the usual visual inspection methods. That's because Youngstown Scrapless Nut Quality Wire comes to you so free from piping, seams, laps, die marks, internal tearing and cupping and nonmetallic inclusions.

Available in various compositions including AISI standard as well as special sulphurized steels. Cold heading bolt wire, of comparable quality, in all standard carbon analysis available for prompt shipment to the bolt and nut industry.

Youngstown

SCRAPLESS NUT QUALITY WIRE

THE YOUNGSTOWN SHEET AND TUBE COMPANY General Offices Youngstown 1, Ohio

Manufacturers of Carbon, Alloy and Yoloy Steel Export Office 500 Fifth Avenue, New York

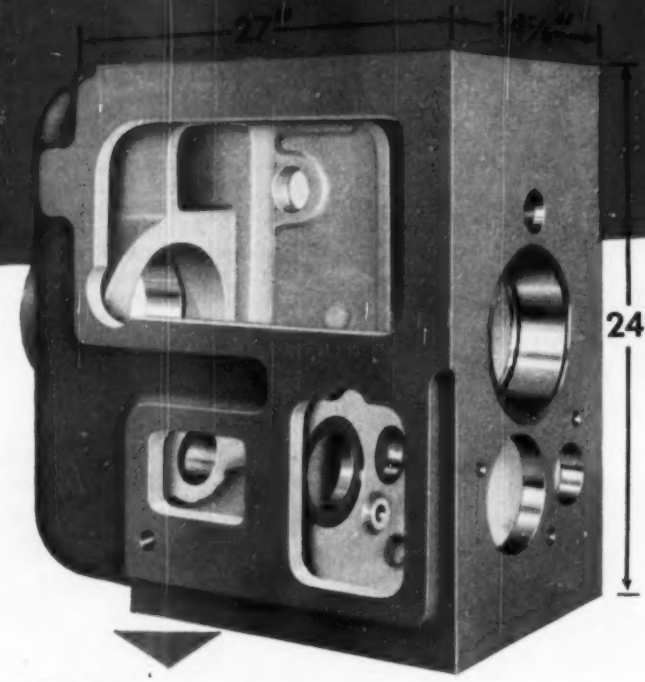
WIRE · ELECTROLYTIC TIN PLATE · COKE TIN PLATE · PIPE AND TUBULAR PRODUCTS · HOT AND COLD FINISHED CARBON AND ALLOY BARS · RODS · SHEETS · PLATES · CONDUIT · RAILROAD TRACK SPIKES

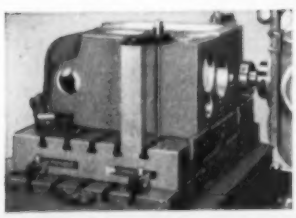
THE "JIGMIL TECHNIQUE" MAKES

JIGLESS BORING

possible on small lot production

- FAST PRODUCTION AND HIGH ACCURACY
- FLEXIBILITY OF APPLICATION FOR SMALL LOT PRODUCTION
- SUBSTANTIAL REDUCTION OF TOOLING COSTS





This casting is processed in lots of 12 on a Model 3B Jigmil. "In Line" Bores are machined with simple Stub Boring Bars to Precise Limits of Alignment by Indexing Workpiece 180°.

Come to Detroit and Investigate the "Jigmil Technique"

Demonstrations at our Plant by Appointment

DEVLIEG MACHINE CO. 450 FAIR AVE. FERNDALE 20 (DETROIT) MICH.

DEVLIEG JIGMIL

"I wouldn't sell it for Twice what it Cost"

PERKINS WELDED SADDLE TANK

PERKINS WELDING SAYS KRW 100-TON PRESS PAID FOR ITSELF IN 60 DAYS THRU MATERIAL AND LABOR SAVINGS!

BIG TRAILER TRUCKS eat up a lot of gas on an average run. For that reason, most are equipped with big "saddle tanks" which hold 125 gallons or more...thus obviating frequent stops to fuel up. Perkins Welding makes these super tanks out of 1/8 inch steel. Until recently, they welded angle stiffeners onto the tanks for extra strength. A KRW Engineer showed them how they could save considerably by forming stiffening ribs on a KRW 100-Ton Press. The result... savings so great that "it paid for itself in 60 days."

"You don't need a sledge to drive a tack". For the same reason...on a big percentage of forming, blanking and stamping work ... you don't need large, heavy-tonnage presses with their high initial and operating costs.

Production records, in a variety of industries, show that KRW Presses greatly reduce costs. First investment is very low, operating costs are still lower. In one instance the purchase price of a KRW Stamping Press was less than the foundation cost for heavier equipment.

KRW Presses are highly flexible...they can be built with platen sizes up to 36" x 60", and can be gap, open or closed end in type. Tonnage pressures can vary from 25 to 100-tons. Because they are hydraulically operated and not mechanically driven, they are quiet and vibrationless in operation. They are equipped with automatic safety and operational controls. Platens can be stopped at any point in their travel.

LET US KNOW YOUR NEEDS ... we are fully equipped to engineer our equipment to handle your work. In the majority of cases, we can make delivery in a fraction of the time required for other type presses. Let us hear from you.

ALL TYPES OF DIES. We are equipped to engineer and build dies to meet your specifications. All we need is available technical data, blue prints and, where practical, a sample piece of work. We'll quote prices and delivery date.

NAME YOUR NEEDS...WE'LL QUOTE PRICE AND QUICK-DELIVERY DATE...MAIL TODAY

K·R·WILSON

215 MAIN ST. · BUFFALO 3, N. Y.

K. R. WILSON, 215 Main St., Buffalo 3, N. Y.

Please quote me prices and information on following type KRW Presses. Please check. Gap ☐ Open End ☐ Closed End ☐

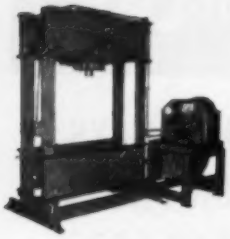
Tonnage Req..... Die Dimensions.....

Name.....

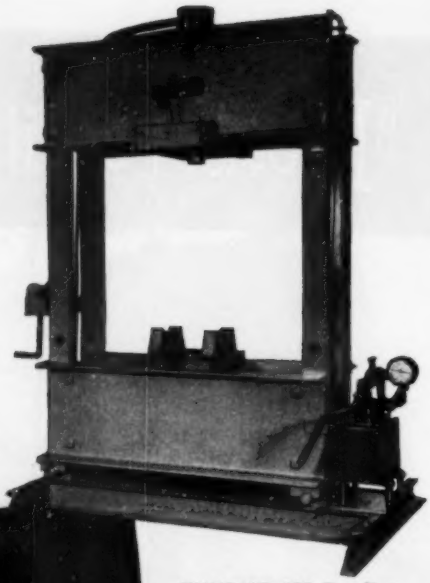
Address.....

City and Zone..... State .....

SPECIAL 150 Ton Open Yoke Vertical Press with adjustable head member and double-acting cylinder.



STANDARD 200 Ton Shop Press with 4-Cylinder Power Pump and double-acting cylinder.



STANDARD 150 Ton Shop Press with new Rodgers 4-Speed Hand Pump capable of producing 10,000 psi. maximum pressure.

...THE FINEST PRESSES FOR THOSE 101 SHOP JOBS

Rodgers
100, 150 AND 200 TON SHOP PRESSES

SPECIAL 150 Ton Shop Press featuring a 96" opening with adjustable head and bolster.

Fast, Versatile Hydraulic Presses With Hand or Power-Driven Pumps

HERE are versatile, time-saving presses you can use in a hundred ways — the Rodgers 100, 150 and 200 Ton Hydraulic Shop Presses, operated with your choice of the new 4-speed Hand Pump or Power Pump.

The standard 100, 150 and 200 Ton Units include many construction and operating features — the cylinder is movable across entire width of upper head member — Two-way Travel Cylinders can be used when necessary to return heavy dies — Sturdy Press Frame permits full pressure to be applied anywhere across 48" width of lower bolster — Bolster adjusts from 12" to 36"—and there are open ends between uprights to accommodate long material extending through.

If specifications on the standard models don't meet your requirements, we'll modify them or build a special press as required.

SEND FOR CATALOG...

New Catalog 313 has descriptions and specifications on the complete line of shop presses.

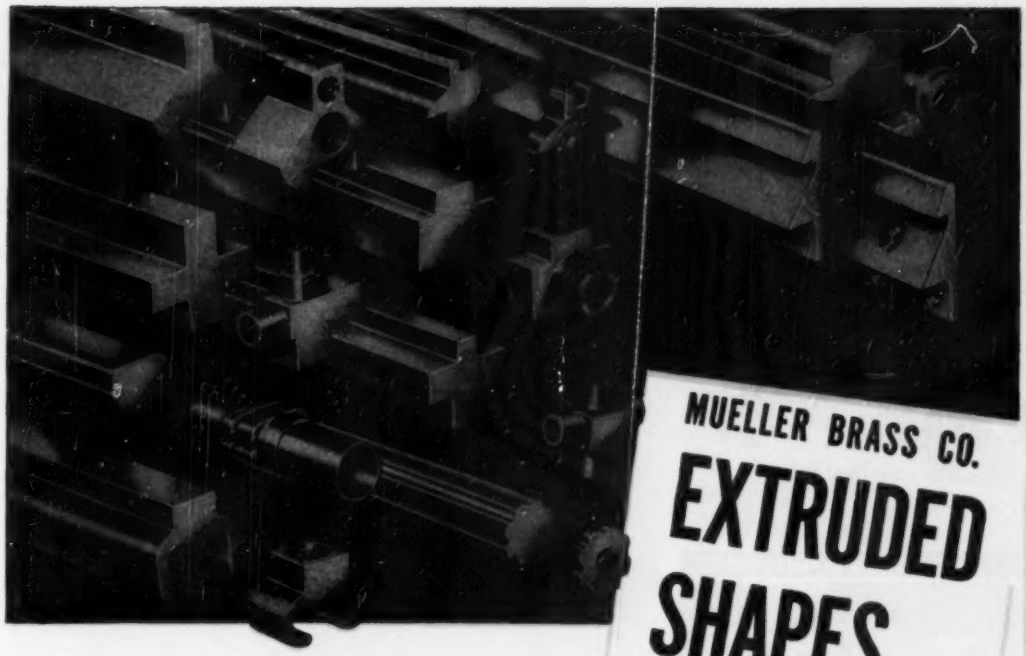
There are standard model Rodgers Shop Presses in 60, 80, 100, 150, 200, 300 and 400 Ton Capacities!

HYDRAULICS Rodgers

Rodgers Hydraulic, Inc.

7407 WALKER ST., ST. LOUIS PARK, MINNEAPOLIS 16, MINN.

HYDRAULIC POWER EQUIPMENT



MUELLER BRASS CO.
EXTRUDED SHAPES...
can lower your production costs!

REDUCE MACHINING OPERATIONS—LESS WASTE—The extruded shape is similar to the shape of the finished product, in some instances merely requiring a milling and drilling operation to complete the finished article.

SAVES TIME—Surfaces are extruded to precision tolerances and to a mirror-like smoothness. Less time is required for buffing and polishing in preparation for final plating.

LESS SCRAP—The sound, dense, fine-grained structure of the metal and absence of porosity result in less rejects, especially where parts must withstand internal pressure.

LONGER TOOL LIFE—Machinability is better—tools last longer and require less grinding, thus permitting steadier production runs.

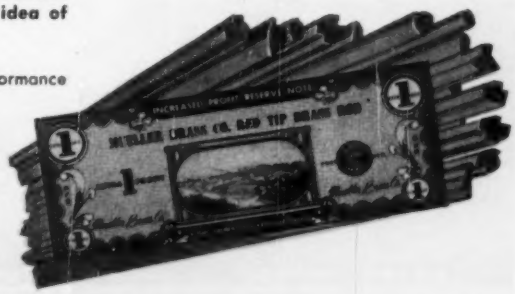
A GREAT VARIETY OF SHAPES AND ALLOYS

The illustrations shown above, of extruded rods and their finished parts, are but a few of the many thousands that can be produced; but they give a general idea of the variety of shapes available.

Do you want more efficient production or better performance of your product? A specially processed rod may be the answer. If you have a problem, please tell us about it, our Technical Engineers and Laboratory are at your disposal.

YOU CAN PIN MORE PROFIT TO YOUR COST SHEET

Mueller Brass Co. Red Tip Brass Rod is a universal, many-purpose, extra-fast cutting Rod. Its constant uniformity saves tools, grinding and "down" time. It actually can be machined at greater speeds than that of which any machine is capable on a continuous production basis. YOU CAN PIN MORE PROFIT TO YOUR COST SHEET BY USING MUELLER BRASS CO. BRASS ROD AND EXTRUDED SHAPES.

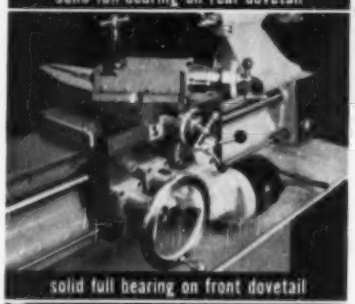


MUELLER BRASS CO.

PORT HURON • MICHIGAN

solid full bearing on top of bed

solid full bearing on rear dovetail


solid full bearing on front dovetail

independent variable electric feed

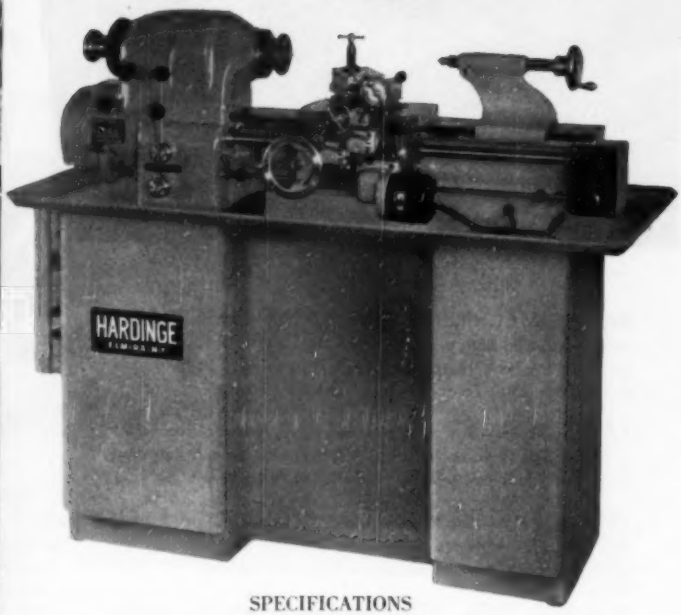
gear box for threading only

solid hardened and ground steel dovetail bed ways

HARDINGE
ELMIRA, N.Y.

THE MODERN DESIGN LATHE
Model HL

6 New EXCLUSIVE HARDINGE FEATURES

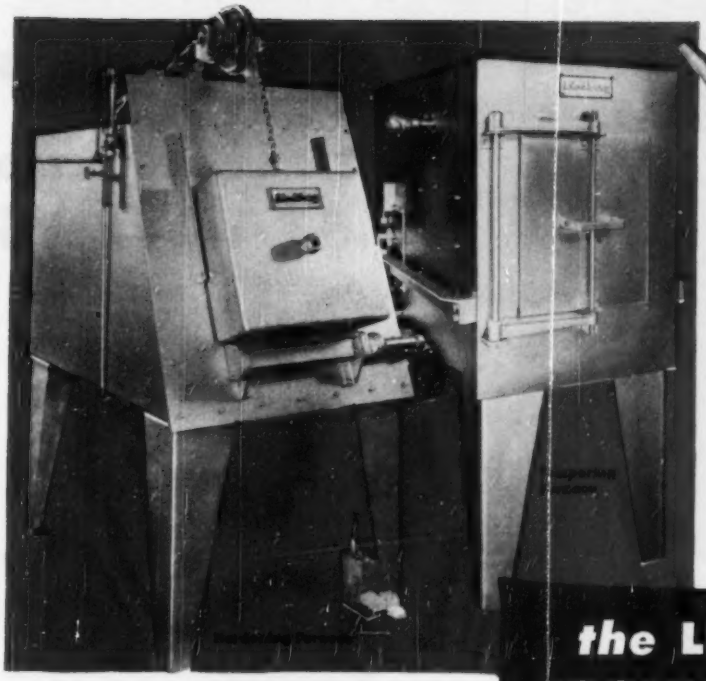


SPECIFICATIONS

Round Collet Capacity—5C HARDINGE	1″
Swing Over Bed	11″
Center Distance	18″
Spindle Speeds	140 to 3100 r.p.m.
(Other Speed Ranges Available)	

DIAMOND ANNIVERSARY
HARDINGE
ELMIRA, N.Y.
1890 - 1950

Offices in principal cities. Export office, 269 Lafayette St., New York 12, N. Y.



BASIC FOR EVERY TOOLROOM

the LINDBERG TOOLROOM TEAM

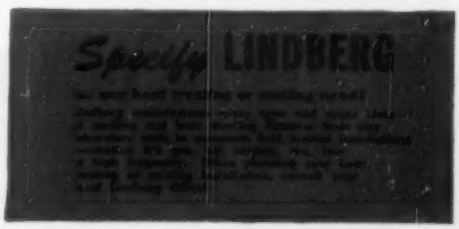
When production depends on tools and dies, tools and dies depend on the LINDBERG TOOLROOM TEAM—a basic requirement in every toolroom—a must where you want the ultimate in tools and dies which will keep your production rate up and your machinery running with a minimum of tool and die failure. The LINDBERG TOOLROOM TEAM gives you the precision heat treating which your precision tools and dies need for lasting performance.

LINDBERG HARDENING FURNACE—eliminates finishing due to scale and decarb with simple accurate atmosphere control.

LINDBERG TEMPERING FURNACE—allows you to obtain the exact "Rockwell Hardness" required for each specific tool or die.

For tools and dies requiring high speed tool steel—investigate the Lindberg "L" Type combination preheat—high heat Furnace.

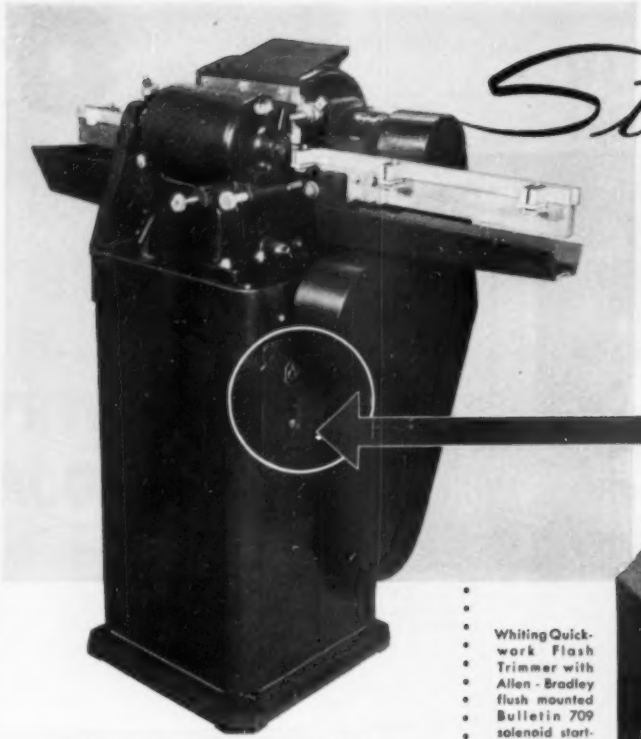
LINDBERG FURNACES



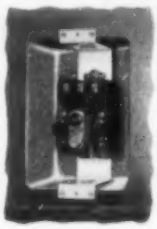
LINDBERG ENGINEERING COMPANY, 2445 W. Hubbard St., Chicago 12, Illinois

Streamline

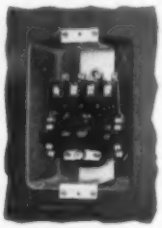
YOUR MACHINES with these FLUSH MOUNTED STARTERS



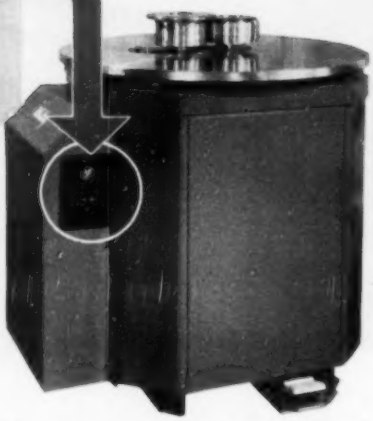
Centerless grinder for plastics, made by Engineering Laboratories, Inc., Pompton Lakes, N. J., with Allen-Bradley Bulletin 609 flush mounted manual motor starter.



Open view of Bulletin 609 flush type manual starter. See illustration above for appearance with cover in position.



Open view of Bulletin 709 flush type solenoid starter. See illustration at right for appearance with cover in position.



Whiting Quick-work Flash Trimmer with Allen-Bradley flush mounted Bulletin 709 solenoid starter equipped with "Start-Stop" buttons.

Machine designers, wanting to improve the appearance of their machines, are using Allen-Bradley flush mounted starters that fit snugly into recesses in machine bases.

This neat construction eliminates surface conduits and protruding switch cabinets. Hence, the machines have a streamlined, modern look that is a distinct sales asset. Be sure to send for Bulletins 609-709, which not only illustrate the flush type starters but also all enclosures in which these starters are available.

Allen-Bradley Co., 1310 S. Second St.
Milwaukee 4, Wisconsin

The Allen-Bradley line includes hundreds of varieties of limit switches for automatic sequence control on any type of machine.

A-B Quality

ALLEN-BRADLEY
SOLENOID MOTOR CONTROL

QUALITY

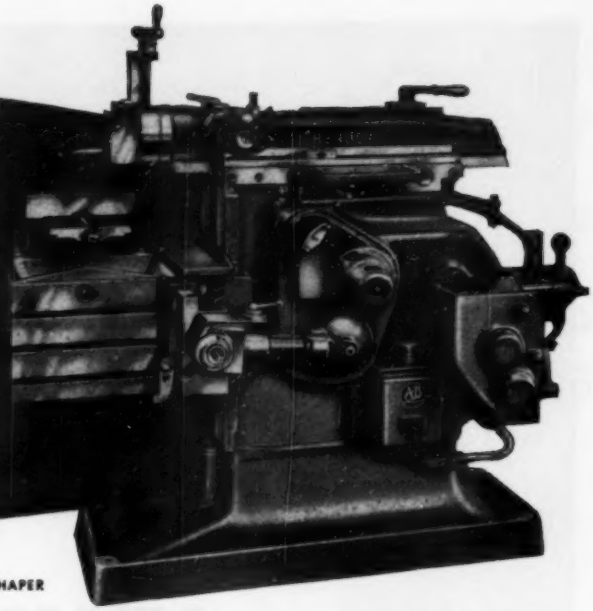
Only ATKINS makes "Silver Steel" SAWS and FILES

And of all fine saws and files, industry rates one kind above the rest — "Silver Steel". "Silver Steel" Saws and Files have won this recognition in the only way that counts — by lasting longer and cutting better; often in service that wears the life right out of lesser saws and files. The reasons *why* go deeply into the science of metallurgy — and Atkins' research and improvement that never ends. But the *results* are easy to measure. Just put Atkins "Silver Steel" Saws and Files to work in *your* plant and watch them cut your cost of cutting.

... of all fine saws — the finest are "Silver Steel" Saws

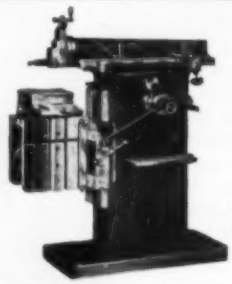
ATKINS

...If you are not using Modern Hendey Machines you are not earning the profits that you should!



1950
12" UNIVERSAL CRANK SHAPER

A comparison of the old Hendey Friction Shaper with the NEW Hendey 12" Universal Crank Shaper will instantly reveal the profit possibilities that you may be missing. The modern Hendey Shaper offers the most complete, up-to-date shaper available today. Full standard equipment means that there are no "extras" to buy. This equipment *includes* table and vise for positioning and indexing work to any angle—flanged mounted motor—mechanical controls *on both sides*—fully automatic lubrication—quick change swivel head—adjustable, preloaded Timken bearings on the bull gear. The 12" Hendey covers a range which makes it ideal for tool room and production work. Hendey Shapers are also available with capacities from 16" to 28", both standard and heavy duty. Write for full details on the modern Hendey Shapers.



1920

Still using old 15" Hendey friction drive shapers? They have only 2 speeds, 21 and 30½ strokes per min., as against 8 speeds from 14—200 for the new 12" shaper. Surveys prove that the new 12" Universal High Speed Crank Shaper covers a majority of all jobs in most plants. Mechanical changes are almost too numerous to mention—improved accuracy, speed and profits on the new 12" shaper will easily convince you of the advisability of changing *now*!

Continuous, advanced engineering by Hendey is worth watching—and must be watched if you are to earn full profits from your lathes and shapers. For complete particulars and prices, contact your nearest Hendey office.

MODERN Hendey

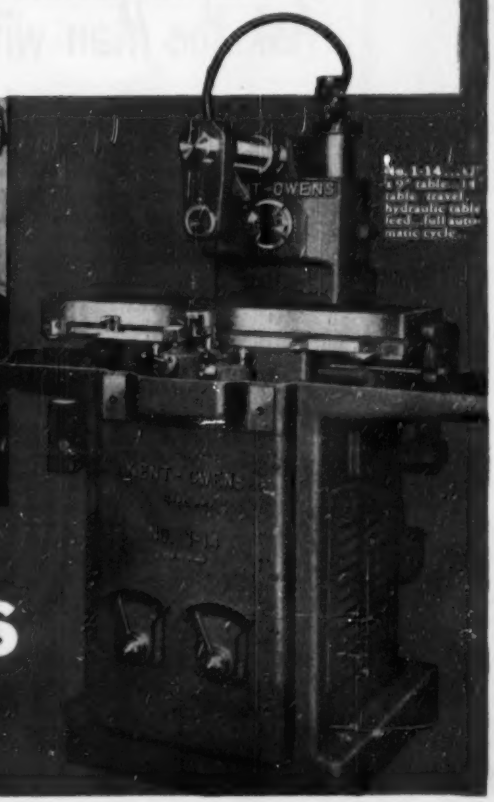
THE HENDEY MACHINE COMPANY
MAIN OFFICE & PLANT: TORRINGTON, CONN.
BRANCH OFFICES: New York, Chicago, Boston, Detroit, Rochester, Los Angeles, San Francisco
REPRESENTATIVES. Philadelphia, Cleveland, Pittsburgh

Breeze right through

TOUGH MILLING JOBS WITH KENT-OWENS MILLING MACHINES

Now is the time to "chart your course" to greater production and lower costs . . . with Kent-Owens Milling Machines!

Designed for *top-speed* and *accuracy* where the going is tough . . . ruggedly built . . . efficient . . . dependable. Especially, you'll like the many practical features of Kent-Owens Machines that save job-time and labor. Write for bulletins on the Kent-Owens Standard line . . . including wide range of hydraulic and hand operated machines. Also, let our engineers help you with special machine requirements. Kent-Owens Machine Co., Toledo, Ohio.



Call on

KENT-OWENS

for Milling Machines

Ask the Man with Holes in His Head!

. . . to cut your boring costs

What'll it get you to ask about boring? Just this—lower costs. Lower costs through savings in time and money. Because "the men with holes in their heads" provide newer, faster, lower cost methods of boring. You may need special bars and special cutters. If so, they'll be designed for you. More likely the right standard Madison cutter in the right Madison bar can give you full production economy . . . and the Madison line of boring tools is broad enough to fit nearly any boring problem. Why not let Madison — experienced specialists in boring and boring only — cut your boring costs? Ask us. A brief letter will do it. No obligation of course.

BETTER BORING TOOLS

Madison's two-bladed cutter provides generous chip clearance — permits faster cutting without overheating. It floats in a Madison bar, special floating tool holders are never needed. More holes per cutter and more regrinds per cutter. Cutters can be changed without disturbing setup. Tolerances to .0003. These and other Madison features cut your boring costs.

MORE BORING EXPERIENCE

Literally thousands of boring jobs have been solved by Madison in the past thirty-five years. With this experience to draw upon, Madison can give you the right answer, sooner. Which means your savings from lower cost production begin sooner, too.

Write for the information filled Madison Catalog: It is yours for the asking.

Tools for rough boring; finish boring; combination rough and finish boring, multiple cutting, bottoming; and other special tools.

MADISON MANUFACTURING CO.

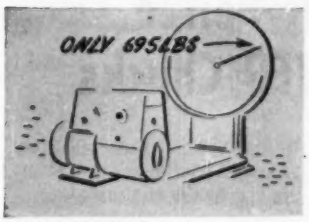
DEPT. AM **MUSKEGON, MICHIGAN**

P&H gives you

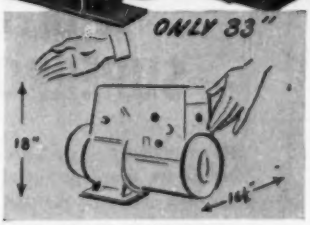
the only DC Arc Welder with *all* these tested time- and money-saving features

BUILT-IN REMOTE CONTROL Dial-lectric feature gives full arc-control at the work . . . saves operator's time . . . saves floor space for production.

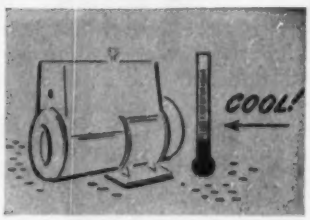
SLOW SPEED Lowest rpm per pound of weight. Only 1750 rpm for less wear, longer life, and minimum replacement costs. So quiet you hardly hear it.



LIGHT WEIGHT Easy to handle and move. Facilitates mounting off the floor and out of the way so there's more room for turning large weldments. Weighs only 695 lbs.



STURDY AND COMPACT Four sets of main brushes and one auxiliary set firmly fastened for good commutation. Simple design and rigid construction throughout . . . space-saving dimensions.



COOL OPERATION Slow speed plus extra large stator-frame cooling surfaces, and dual fans (for generator and motor) — make this the coolest welder you have ever seen.

● Stationary or portable mountings—Additional Features: single heat control; life-time sealed bearings; push-button start- and -stop switch with overload protection; high-low range switch; and polarity reversing switch. Get all the facts. Call your P&H representative, or send in coupon.

P&H **WELDING DIVISION**
Milwaukee 14, Wisconsin

HARNISCHFEGER CORPORATION

Uniform, top-quality electrodes for every job!

TEAR OUT COUPON AND MAIL TODAY!

HARNISCHFEGER CORPORATION, Welding Division 2117
4515 W. National Ave., Milwaukee 14, Wisconsin

Please send me Bulletin W-80 giving full details about the outstanding new P&H WFA-300 DC arc welding machine.

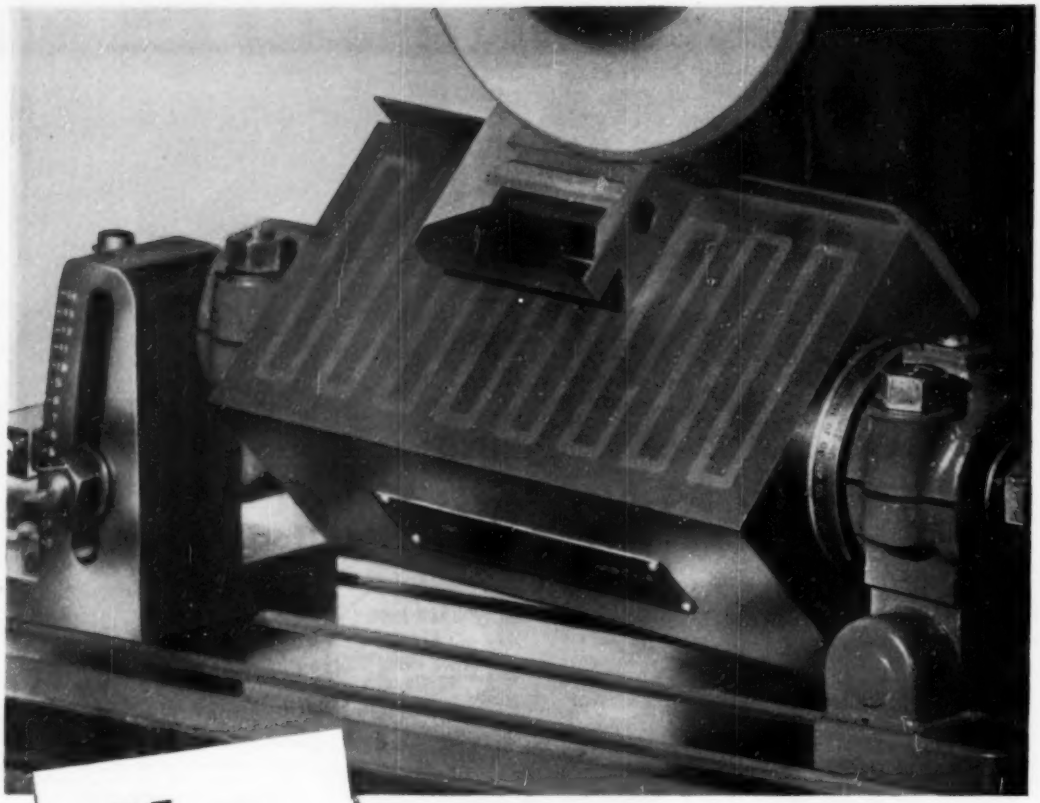
Name.....

Company.....Title.....

Address.....Home ☐ Business ☐

City.....(.....) State.....

EXCAVATORS • OVERHEAD CRANES • HOISTS • ARC WELDERS AND ELECTRODES • SOIL STABILIZER • CRAWLER AND TRUCK CRANES • DIESEL ENGINES • CANE LOADERS • PRE-ASSEMBLED HOMES



You are Far Safer

with Taft-Peirce SUPERPOWER Chucks

NO SLIPPING! Taft-Peirce SUPERPOWER *Electro*-Magnetic chucks are more powerful than other chucks of equivalent dimension. Danger of work slipping is virtually eliminated.

ABSOLUTELY SHOCKPROOF! All electrical components are positively and permanently sealed within the chuck body against moisture, electrical damage, and mechanical shock.

GENEROUS SAFETY FACTOR! For your protection all coils and insulation are designed and tested to withstand rated electrical loads with a generous factor of safety.

LOW MAGNETIC LOSSES! Body, cores, face plate grid, and pole pieces are made of a low carbon steel of high magnetic permeability. . . . Because magnetic losses are low, holding power is unusually great.

MORE VERSATILE! Because magnetic flux is heavily concentrated at the face plate, unusual versatility of set-up is possible with SUPERPOWER *Electro*-magnetic chucks.

THE TAFT-PEIRCE MANUFACTURING COMPANY
WOONSOCKET, RHODE ISLAND

They LOOM LARGE in an Efficient Production Schedule

U. S. PAT. No. 2054189

MIDLAND WELDING NUTS

5/8" F-2016-A

1/2" F-2012

3/8" F-2008

5/16" F-2006

1/4" F-2004

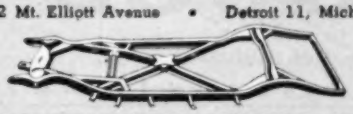
- Self locating, assuring accuracy and rapid assembly without locating pins or fixtures.

Reduce inventory. Midland Welding Nuts can be used on a wide variety of metal thicknesses, eliminating different heights of collars.

Offer many other advantages. Write, wire or phone for complete information.

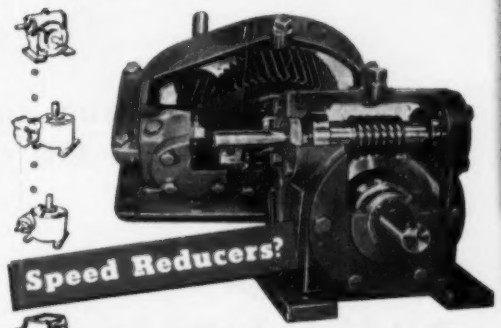
The MIDLAND STEEL PRODUCTS CO.

6662 Mt. Elliott Avenue • Detroit 11, Michigan



WORLD'S LARGEST MANUFACTURERS OF AUTOMOBILE FRAMES—

Chances are you'll find the gear you want available from Grant's mammoth stock. If not, complete facilities are available to cut all types. Deliveries made on your schedule. Write today for free catalog describing complete line.

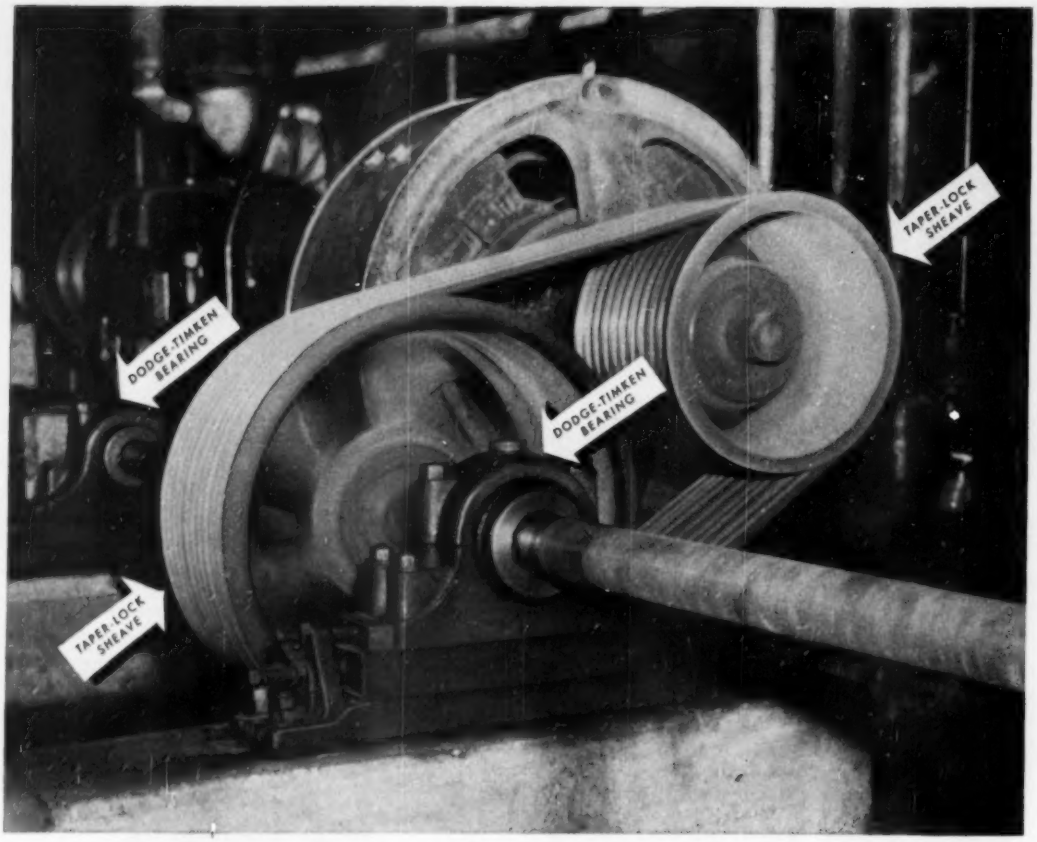


Worm, double worm, compound worm and spur, helical, mitre gear — Grant makes them all . . . reductions up to 3660-1 . . . most types available from stock. Write for catalog describing each type in detail.

Special requirements? . . . unusual and difficult jobs are a Grant specialty . . . for an estimate write outlining your problem.

Grant GEAR WORKS INC.

169 W. SECOND STREET
SO. BOSTON, MASS.



The Team That Cuts Production Costs on 100 Million Patterns

Fashion patterns, 100 million a year, are produced to sell at popular prices on the thoroughly *modern* equipment of the Simplicity Pattern Co. Dodge TAPER-LOCK V-Belt Drives, running on Dodge-Timken Bearings, enable Simplicity to save power, keep production rolling.

Equipment to produce at lower cost is your answer in today's competitive markets. Dodge "firsts" in power transmission machinery are helping in thousands of plants to modernize operations. . . . Get the facts about Dodge developments — Bearings, V-Belt Drives, Clutches and the new Torque-Arm Speed Reducer!

DODGE MANUFACTURING CORPORATION, 100 Union St., Mishawaka, Ind.

DODGE-TIMKEN
PILLOW BLOCKS

mounted, sealed, housed, fully assembled, ready to lock on the shaft and carry your power loads with new efficiency. Delivered from stock in four basic types and a vast range of sizes. Write for data.

CALL A TRANSMISSIONEER

He's factory-trained to help solve your power-drive problems. Look for his name under "Power Transmission Equipment" in your classified telephone directory.

DODGE
of Mishawaka, Ind.

FIRST IN POWER TRANSMISSION MACHINERY

NAME PLATES

FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY, ETCHING COMPANY OF AMERICA, 1520 MONTANA STREET, CHICAGO 14, ILLINOIS

PRODUCTION MEN —LIKE THESE 3 IN PHILADELPHIA—

USE SUNNEN HONING ON I.D.'s

Corrects Distortion • Produces Free-Running Fits • Saves Time On Production of Accurate Parts • Speeds Assembly

IMPROVES PERFORMANCE, ADDS EXTRA LIFE TO PARTS, because Sunnen Honing produces holes that are geometrically true, straight and round, free from bell-mouth, taper and warpage.

SUNNEN HONING CUTS PRODUCTION TIME, TOO, because it: Eliminates chucking, fixtures, and set-up time • Eliminates selective fitting • Reduces rejects • Removes cross-drill burrs and flash with amazing speed • Rounds up holes and removes scale after heat-treating.

Versatile Sunnen Honing Machines are solving production problems for many of America's most prominent manufacturers. And they save time and money on salvage, maintenance, experimental and tool room work. Stationary equipment hones diameters from .120" to 5.5" — portable equipment range, .185" to 14.5". Hones open and blind holes — handles holes with keyways, ports, and lands — any metal, any hardness; as well as ceramics, glass and plastics.

For less than $1000.00 you can have a complete Sunnen Honing installation. For long runs or short, you profit from the many advantages of Sunnen Honing. Mail the coupon for details.

SUNNEN PRODUCTS COMPANY
7921 Manchester Ave., St. Louis 17, Mo.
Canadian Factory: Chatham, Ontario

USE EXTERNAL HONING TO MATCH THE ACCURACY OF THE BORE

For perfect fitting of precision parts — without selective assembly — use Sunnen internal honing for the bore, and Sunnen external honing for the mating part. External honing range .120" to 2.750", for pins, plungers, shafts, arbors, spindles, pistons, etc. Write for bulletin.

-535

"Rounds Up Bore For Free-Sliding Fit."

Anthony Giannini
Supervisor
Yale & Towne Mfg. Co.

Slow-speed gear
Material — Drop forging
Hardness — Rockwell 50-60 "C"
Hole diameter — 1.291"
Length — 2¾"
Tolerance — .001"
Finish — Smooth
Stock Removal — .0002" to .0015"
Production — 45 per hour

"Improves Performance — Extends Service Life."

Albert Molnar
Plant Superintendent
Jacquard Knitting Machine Co.

Clutch roller housing
Material — 1020 steel
Hardness — Rockwell 60 "C"
Hole Diameter — 1.248"
Length — 1.250"
Tolerance — .00025"
Finish — smooth
Stock removal — .002"
Production — 50 per hour

"Speeds Assembly — Improves Operation."

Holman J. Allen
General Foreman
I. T. E. Circuit Breaker Co.

Circuit breaker latch — 3 holes, 2 in alignment
Material — Laminated steel
Hardness — Rockwell 60 "C"
Hole diameter — .500" and .4375"
Length — 2⅛" and ⅞"
Tolerance — .0005"
Finish — 10-12 micro-inches
Stock removal — .001" to .0015"
Production — 90 holes per hour

SUNNEN PRODUCTS COMPANY
7921 Manchester Ave., St. Louis 17, Mo.

☐ Send Free Bulletin MB-12 (Production Honing)
☐ Send Free Bulletin MB-10 (Tool Room Honing)
☐ Have your representative call.

Name.....
Company.....
Address.....
City..... State.....

New DICKERMAN 9-INCH ROL-DI-FEED

Revolutionary Automatic Punch Press Feed!

A COMPACT SELF-CONTAINED CAM DRIVEN FEED

GENERAL SPECIFICATIONS

CAPACITY

Handles coiled or short strip up to 3/16" thick and any width developed for a given thickness of stock where weight of stock does not exceed 2 pounds per linear foot.

MAXIMUM FEED LENGTH

9" on presses having 3" or more of stroke and approximately three times the stroke for strokes under 3". Feed length adjustable in increments of .001".

MOUNTING SPACE REQUIRED

For Feed — 3" x 9" Wide
For Cam — 3" x 3¾" Wide

PHYSICAL DIMENSIONS

Length Overall — 22"
Width Overall — 12"
Height Overall — 9"
Shipping Wgt. — 100 lbs.

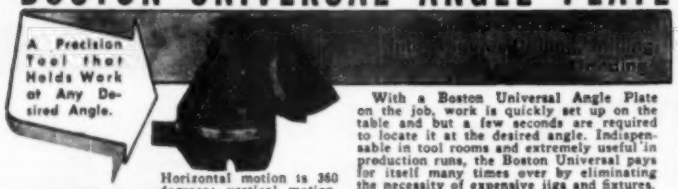
This New Revolutionary Dickerman Rol-Di-Feed is a compact, self-contained Cam Driven Feed which can be easily installed on press bolster or directly into some die shoes to feed stock in any desired direction.

It will feed metal, fibre, paper, mica, plastic, etc., in unlimited range of width, from continuous coils or short lengths. Provides increased range and versatility seldom found in larger, more costly feeds.

Install this New Dickerman Rol-Di-Feed for simplicity, adaptability, economy and feeding accuracy. Write for detailed information and price.

H. E. DICKERMAN MANUFACTURING COMPANY

BOSTON UNIVERSAL ANGLE PLATE



Horizontal motion is 360 degrees; vertical motion, 120 degrees. Fitted with vernier scale reading to 5 minutes.

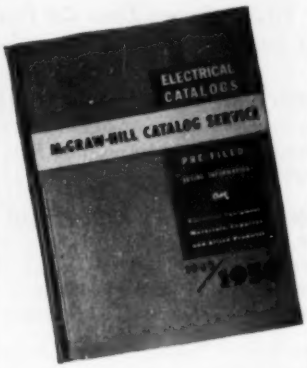
With a Boston Universal Angle Plate on the job, work is quickly set up on the table and but a few seconds are required to locate it at the desired angle. Indispensable in tool rooms and extremely useful in production runs, the Boston Universal pays for itself many times over by eliminating the necessity of expensive jigs and fixtures.

Made in several stock sizes.
Write today for full information.

US AUTOMATIC BOX MACHINERY CO., INC.
18 ARBORETUM ROAD · BOSTON 31, MASSACHUSETTS

When the need for an electrical product arises in your plant, get the habit of referring to the

McGRAW-HILL Pre-Filed ELECTRICAL CATALOGS



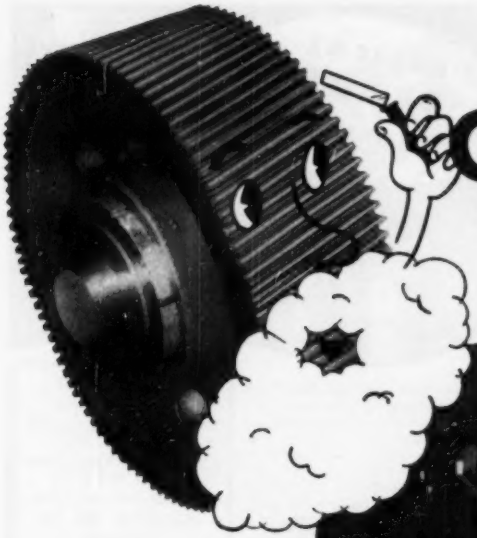
Several hundred pages of manufacturers' buying information will help you compare and select.

The directory lists all known manufacturers, classified alphabetically and by product.

If the Pre-Filed ELECTRICAL CATALOGS are not available for buying reference at your plant, write to:

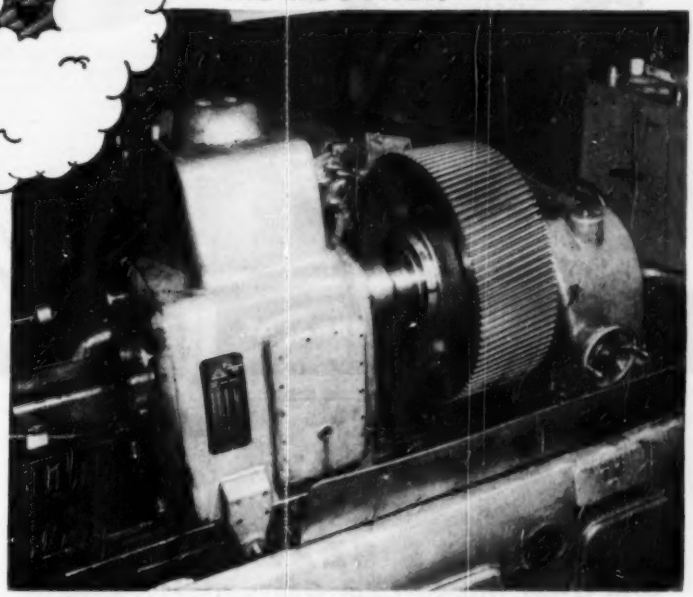
McGRAW-HILL CATALOG SERVICE
330 W. 42nd St., New York 18, N.Y.

There is no charge to qualified users.



GEARS SHAVED

...FOR GREATER ACCURACY ...SMOOTHER FINISH



We are equipped to shave teeth on spur and helical gears up to 38" P.D., 36" Face, 45° Helix angle, 16 D.P. to 2 D.P.

Here at Phillie Gear, no manufacturing method or innovation that will enable the production of the finest in gears is ever overlooked. In keeping with this policy is our Gear Shaving equipment . . . an entirely different operation from gear cutting. The result of gear shaving is a more accurate, smoother finished gear which will give longer service and have greater load carrying ability. Among other advantages of gear shaving are . . . it corrects eccentricity . . . corrects the helical angle . . . produces a bright smooth surface. Shaving of "green" gears before hardening reduces considerably the lapping and grinding operations normally required after hardening.

Send for a copy of our gear catalog.
Write on your business letterhead please.

Philadelphia Gear Works, INC.

ERIE AVE. AND G ST., PHILADELPHIA 34, PA.
NEW YORK • PITTSBURGH • CHICAGO • HOUSTON
IN CANADA: WILLIAM AND J. G. GREEY LIMITED, TORONTO

Industrial Gears and Speed Reducers
LimiTorque Valve Controls

A MEMO TO ENGINEERS
...about "Controlled" GEARS

"WEAR RESISTANCE" due to "CONTROLLED" heat treating in our own shop, assures specified surface hardness to resist wear under modern high-speed heavy-load conditions. Quality materials ONLY with strength and toughness reduces breakage from shock.

MACHINED TO MICRO-FINISH
By skilled craftsmen . . . Men who know gear cutting!

OVER 40 YEARS GEAR CUTTING EXPERIENCE

SPECIAL MACHINING JOBS

Complete modern shop facilities to handle machining of special work, shafts, gears, etc. Have your work done in modern shops by highly skilled machinists for best results.

SEND PRINTS
. . . for low cost quotations, get the "Wear Resistant" story!

WRITE FOR COMPLETE INFORMATION NOW!

AUTO ENGINE WORKS, INC.
341 N. HAMLINE AVE. ST. PAUL 4, MINN.

Shown above in process of hobbing are helical gears destined for a rugged life in the steel-making industry. Inbuilt accuracy and stamina are assured by Stahl's specialized skill and experience in producing gears of all types and sizes accurately, economically and on time. For your gear needs, in any quantity, get Stahl's estimate first.

SPURS TO 72" PD, 1 DP
BEVELS TO 54" PD, 1 DP
SPIRAL, HELICAL and WORM GEARS TO 48" PD, 2 DP
CONTINUOUS-TOOTH HERRINGBONE TO 60" PD, 2 DP
SPROCKETS TO 72" PD, 2½" CP
RACKS TO 20 FT. LONG, 3 DP
SILENT GEARS: RAWHIDE, BAKELITE, FABROIL
HEAT-TREATED, CASE OR FLAME HARDENED GEARS – OF CARBON OR ALLOY STEEL

Stahl
GEAR & MACHINE COMPANY
3901 Hamilton Ave. Cleveland 14, Ohio

ELLIPTICAL GEARS
Also Other Non-Circular Gears

ALL TYPES OF GEARS

BILGRAM GEAR & MACHINE WORKS
1217-23 Spring Garden, Philadelphia, Pa.

MP QUALITY GEARS CUT TO ORDER MP

● MEISEL produces but one *kind* of gears . . . gears constructed for specific jobs. Only through the inherent accuracy of this special designing could such dependability, performance and economy be possible. Tell us what you expect it to do, and we'll show you the *one* gear suited for your job.

MEISEL PRESS MFG. CO.
946 Dorchester Avenue Boston, Mass.

GANSCHOW CUT GEARS.

SPUR—SPIRAL
BEVEL—RACK
AND PINION

MEMBER OF AGMA

UP TO 60" PITCH DIA.
UP TO 10" FACE WIDTH

GANSCHOW GEAR CO • 14 N. MORGAN ST., CHICAGO 7

Precision Die Made—Lowest Possible Cost.

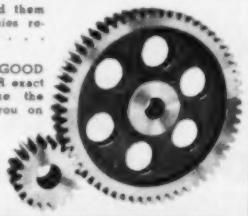
DAYTON ROGERS MFG. CO., Minneapolis 7, Minnesota

In scores of industries users of CINCINNATI GEARS, GOOD GEARS ONLY, have developed an affectionate respect for their performance, accuracy and longer life.

Ask any user . . . you'll find them enthusiastic about the economies resulting from faster assembly . . . uniformity and effective results.

Each CINCINNATI GEAR, GOOD GEAR ONLY, is made to YOUR exact specifications. We would like the opportunity of working with you on your gear problems.

Spur Sprocket Bevel
Internal Helical *Zerol
***Coniflex Spline Worm**
Spiral Bevel



*REG. U. S. PAT. OFFICE

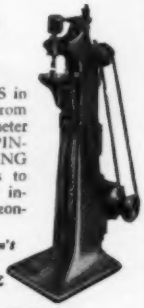
THE CINCINNATI GEAR COMPANY
"Gears . . . Good Gears Only"
Wooster Pike and Mariemont Ave. ★ Cincinnati 27, Ohio

GRANT

RIVETERS — PIONEERS in their line—head rivets from smallest to ¾" diameter either by NOISELESS SPINNING or VIBRATING HAMMER method—Sizes to meet all needs—Types include Vertical and Horizontal Multiple Spindles.

Write for literature and don't forget to send samples.

THE GRANT MFG. & MACHINE CO.
85 Silliman Ave., Bridgeport, Conn., U. S. A.



SPUR, BEVEL, HELICAL
AND WORM GEARS
SPROCKETS
WORMS
RACK

GLOBE GEARS

LARGE
OR SMALL LOTS
ORIGINAL EQUIPMENT
INQUIRIES INVITED.

GLOBE GEAR COMPANY
719 N. 24th ST. PHILADELPHIA 30, PA.

ATLANTIC GEARS

SPUR-SPIRAL-WORM-BEVEL GEARS GENERATED WITH PRECISION ON MODERN EQUIPMENT • SEND SAMPLES OR BLUE-PRINT FOR QUOTATION!

ATLANTIC GEAR WORKS, INC. Call
200D LAFAYETTE ST • N.Y. 12, N.Y. CA 6-1440

GEAR CUTTING MACHINES

Well designed . . . good features . . . create production advantages.

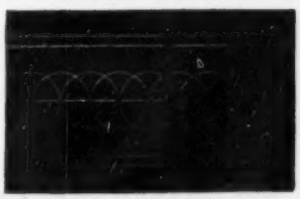
NEWARK GEAR CUTTING MACHINE CO.
69 PROSPECT ST., NEWARK 5, N. J.

Represented by:

Pratt & Whitney . . . head office, West Hartford, Conn.
John Bertram & Sons Co., Ltd. . . . head office, Dundas, Ontario, Canada.
Alfred Herbert, Ltd. . . . head office, Coventry, England.

DYKEM STEEL BLUE

STOPS LOSSES
making dies & templates

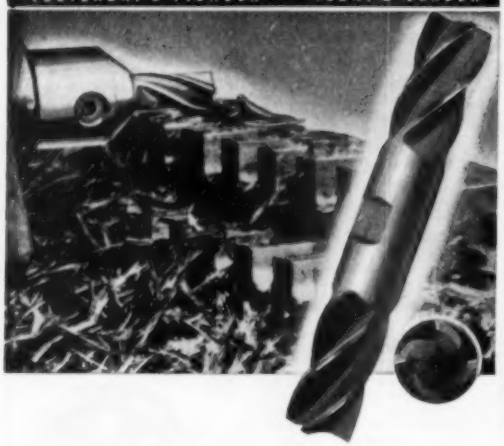


Simply brush on right at the bench; ready for the layout in a few minutes. The dark blue background makes the scribed layout lines show up in sharp relief, and at the same time prevents metal glare. Increases efficiency and accuracy.

Write for full information

THE DYKEM COMPANY, 2301 B North 11 St., St. Louis, Mo.

YESTERDAY'S PIONEER . . . TODAY'S LEADER



Weldon
Double-End End Mills

IT'S THE TEETH THAT TELL

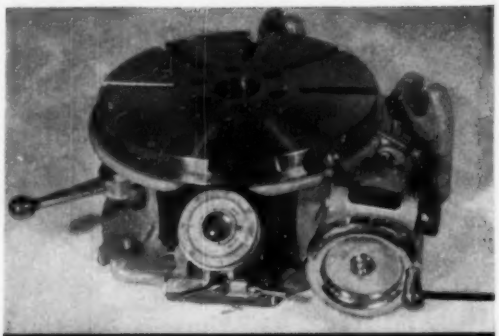
It's the "teeth" in Weldon End Mills that tell the story of more production and bigger profits on your jobs.

Weldon pioneered in producing *scientifically designed* teeth for end mills, a step over 25 years ago that opened the door to higher speeds, and faster feeds.

After lengthy experiment and study, the *tooth shape* and *spiral angle* on Weldon End Mills were radically altered from conventional styles. The result was a tooth, that *allows chips to curl out without clogging* and *insures better performance* and *longer life* for the tool.

Call the Weldon representative for more information.

THE WELDON TOOL CO. Cleveland 4, Ohio
3000 WOODHILL ROAD



presenting OPL Optically Controlled
ROTARY INDEXING TABLE

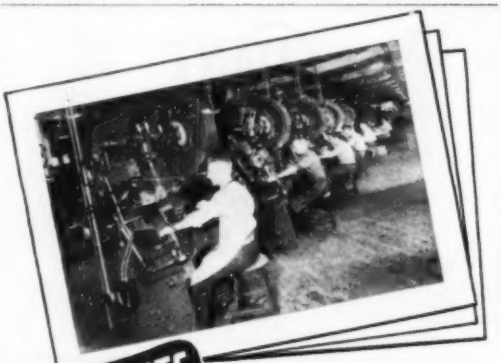
Incorporating many distinctive features, this new optically controlled rotary indexing table is offered you following the wide success met by our OPL Dividing Head:

Features

- For use on machines permitting operators to index and divide their work with a speed and accuracy not possible with mechanically controlled equipment.
- Accuracy.
- Ease of viewing (even at 12-inch distance).
- Will operate in either vertical or horizontal position.
- Constructed for long life of finest alloy irons and steels.

Write us today for details.

F. T. GRISWOLD MFG. CO.
305 W. LANCASTER AVENUE WAYNE, PENNA.



FERRACUTE INCLINABLES
on the line at Burroughs

This battery of Ferracute streamlined open-backed inclinable presses cuts production costs in the Detroit plant of Burroughs Adding Machine Co. Write for full details. Sizes from 6 to 150 tons.

FERRACUTE MACHINE CO.
Bridgeton, New Jersey

Give to Conquer CANCER

Strike Back!

THE fight is on to save more lives in 1950! Now is the time to back science to the hilt in its all out battle against cancer.

Tremendous gains have already been made. Last year, 67,000 men, women and children were rescued from cancer. Many more can be saved—if *you* resolve to save them—if *you* strike back at cancer.

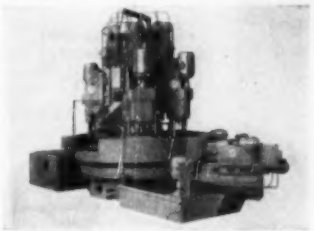
Give! Give your dimes and quarters and dollars. More treatment facilities are needed, more skilled physicians, more medical equipment and laboratories. The success of great research and educational programs depends on your support.

Your contribution to the American Cancer Society supports these vital efforts. It helps guard your neighbor, yourself, your loved ones. So this year, strike back at cancer . . . Give more than before . . . Give as generously as you can.

American Cancer Society

Help Maintain Production of 166 Pieces Per Hour — Lower Maintenance Costs

When you need high production with low unit and maintenance costs, consider the advantages of Roto-Matics. In this case the Roto-Matic is a station-type machine with indexing table. Drilling and reaming both suspension and king pin holes in front suspension support arms are performed at the rate of 83 pairs or 166 pieces per hour



General view of drilling and reaming machine equipped with new Roto-Matic mechanical power heads.

An outstanding new Davis and Thompson development incorporated in the design of this machine are the Roto-Matic mechanical, electrical power heads operated by screw feeds. Included among the safety features are overload release clutches on the feed screws. Six heads are used, three vertical and three horizontal. Lower maintenance costs are obtained through elimination of excessive servicing.

Machines similar to this can be designed to handle dissimilar operations in the same parts or one operation on continuous production. Investigate the profitable applications of Roto-Matics.

FREE DATA
will be furnished upon request. Write today. Ask for bulletin AM-1

DAVIS and THOMPSON Roto-Matic

Davis & Thompson Company
6411 W. BURNHAM ST., MILWAUKEE 14, WISCONSIN

From The *American Machinist* Library of *Tips for Top Shop Men*

THE man who can't keep regular hours or follow regular habits may be too expensive to keep, regardless of his ability. His effect on morale may be more costly than his extra value as an individual.

EVEN when you are sure your solution to a problem will work, have an extra one ready, just in case. You'll be surprised how many men are caught napping by the failure of "sure-fire" solutions.

MONEY-MAKER!

A SINGLE-UNIT SELF-CONTAINED
MOTOR DRIVEN TIME AND LABOR SAVER—

Use It For
- Rotary Milling and Indexing
- An Automatic Revolving Fixture
- Automatic Indexing
- Automatic Cycle Milling
- Cam Milling
- Special-Purpose Machines, etc.

MOTOR-DRIVEN 20" ROTARY TABLE

- Eliminates all setup time — just plug into nearest electric outlet
- 18 Quick cutting feed changes — 1½" to 54" or 3" to 108"

Write Us In Confidence
About Your Special Problems

W. B. KNIGHT
MACHINERY COMPANY

3820 WEST PINE BLVD.
ST. LOUIS 8, MISSOURI

Return Coupon
FOR COMPLETE DETAILS

ATTACH TO YOUR LETTERHEAD

W. B. KNIGHT MACHINERY CO., 3920 West Pine, St. Louis 8, Mo.
Send catalog page and price on the Knight 20" Rotary Table.

Name _____

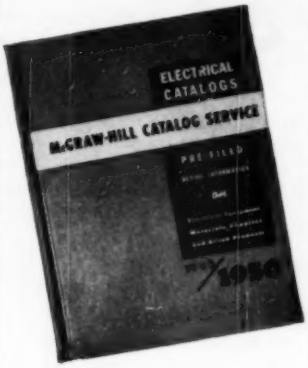
Title _____

KNIGHT

MORE GOODS for MORE PEOPLE at LOWER COST

Thousands
of busy men
in industry find it
a time-saving habit
to use the . . .

McGRAW-HILL
Pre-Filed
ELECTRICAL CATALOGS



when they want the answers
to these buying questions
about electrical products:

Who makes the product?
Who makes the product best suited to my needs?
Where can I buy it?

If the Pre-Filed ELECTRICAL CATALOGS are not available for buying reference at your plant, write to:

McGRAW-HILL CATALOG SERVICE
330 W. 42nd St., New York 18, N.Y.

There is no charge to qualified users.

From The *American Machinist* Library of *Tips for Top Shop Men*

EVERY man should have some incentive—a better job, better pay, more time off, increased recognition, or some such. Why limit incentives to production workers? The staff and indirect men can perish of neglect just as easily.

WHEN you don't know, say so—and find out. Some people can get away with not knowing, but most of us can't. It's safer to confess—and find out. You may fool others for a time by fast talking, but you usually end up by fooling yourself.

Announcing . . . . the SIDNEY FLUID TRACER

another **NEW FEATURE** to increase production—lower costs

● Now, count on your Sidney Lathe for greater than ever versatility . . . a wider range of work, more production at lower cost.

THE NEW SIDNEY FLUID TRACER attached to any Sidney Model 32 Lathe will reproduce your work from either flat or round template . . . an all-hydraulic control, it serves the dual purpose of tracing and regular lathe work without limiting the range of either . . . increases the value of your lathe investment . . . eliminates the necessity of extra expense for a single purpose tool.

Position only one lever on the clutch and brake unit to engage or disengage the tracer unit . . . as simple as that. No loss of valuable time . . . no extra units to store . . . no parts to put on or take off when changing over from tracing to standard lathe operation.

The Sidney Fluid Tracer gives you the same precision work accuracy for which all Sidney products are famous. Any change in the contour of the master piece is instantly transmitted through the ultra-sensitive tracer valve . . . even sharp shoulders are faced to extremely close limits.

Combine the Sidney Fluid Tracer with any Sidney Model 32 Lathe and you have, without question, the finest turning tool ever produced.

Write for detailed literature, or see your nearest Sidney representative

Sidney hydraulically controlled clutch and brake regulates oil flow, and synchronizes longitudinal feed with cross slide travel . . . also bypasses oil flow in regular lathe work.

Here are samples of reproduction work performed by the Sidney Fluid Tracer . . . accurate, faithful tracing of any contours in the master piece.

SIDNEY MACHINE TOOL COMPANY • SIDNEY, OHIO

Builders of Precision Machinery Since 1904

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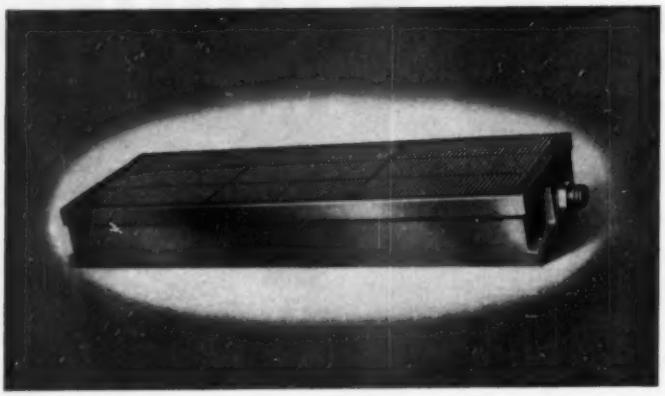

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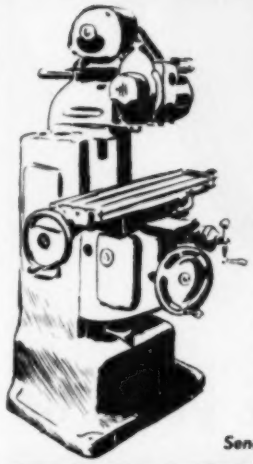

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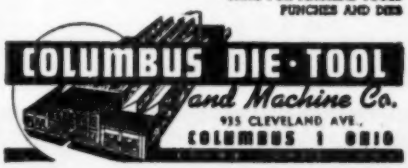

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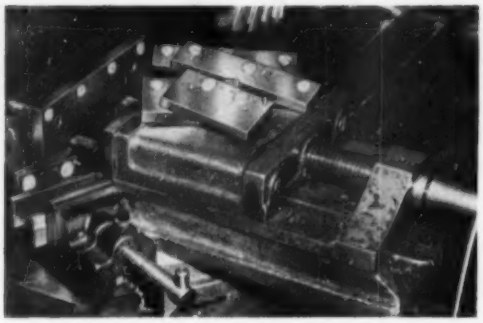

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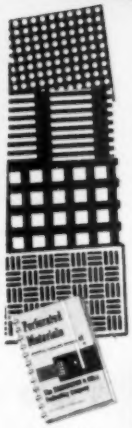

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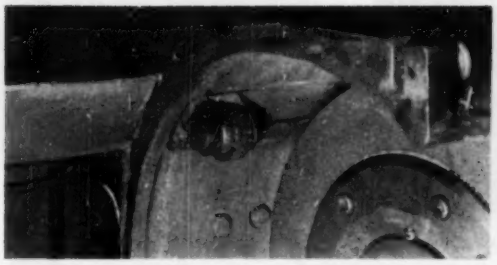

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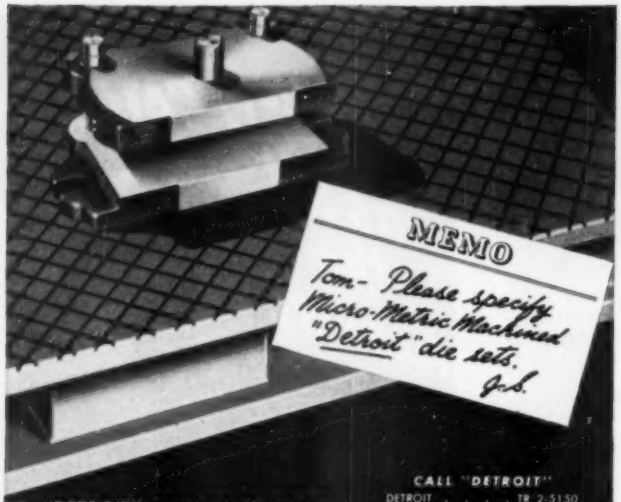

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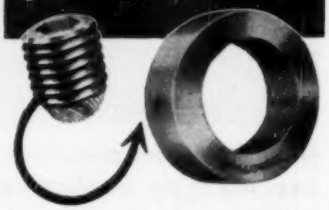

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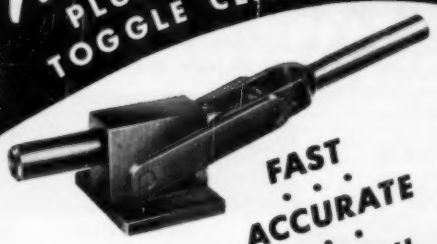

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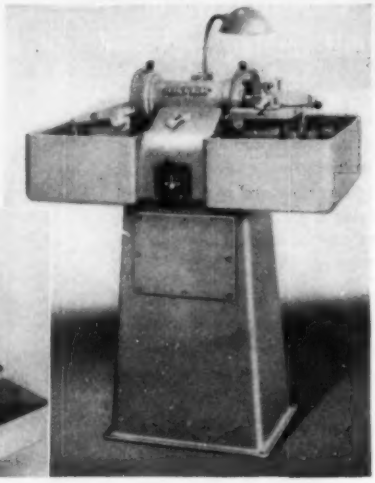

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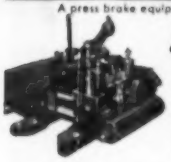

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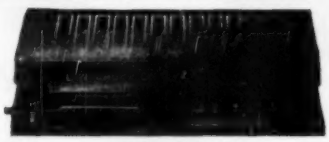

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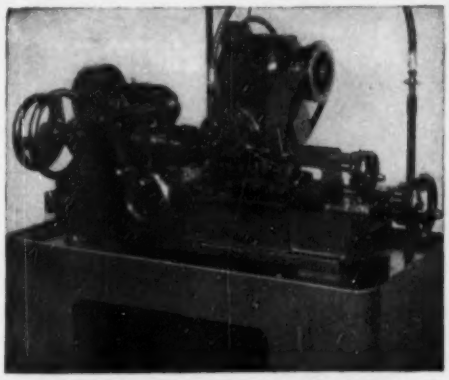

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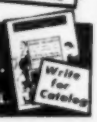

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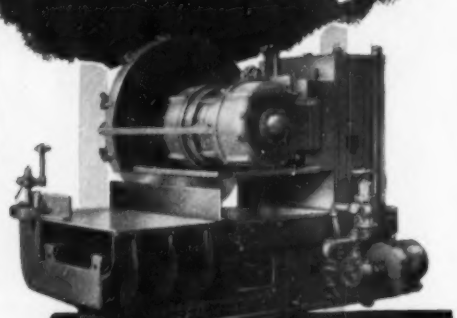
Modern Sawing



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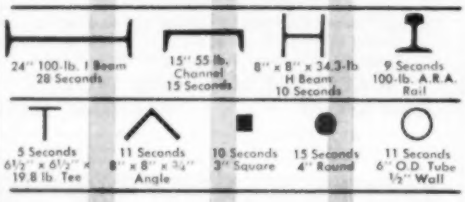

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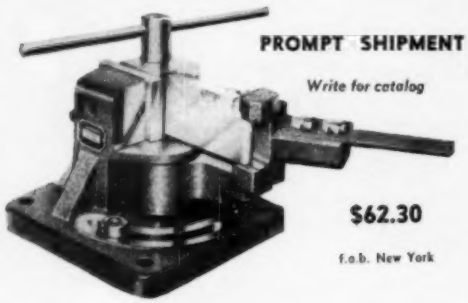

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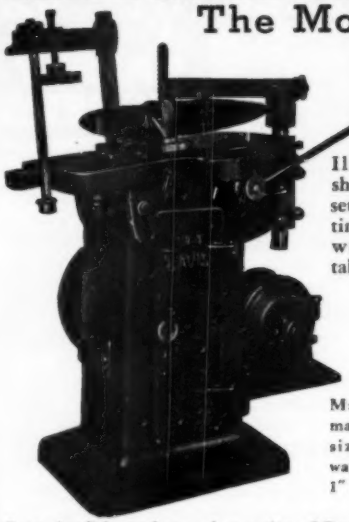

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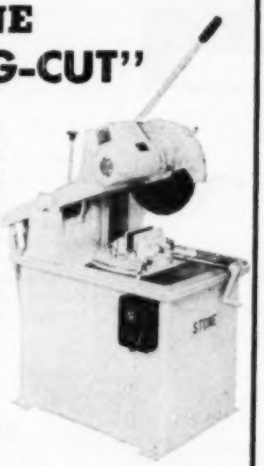

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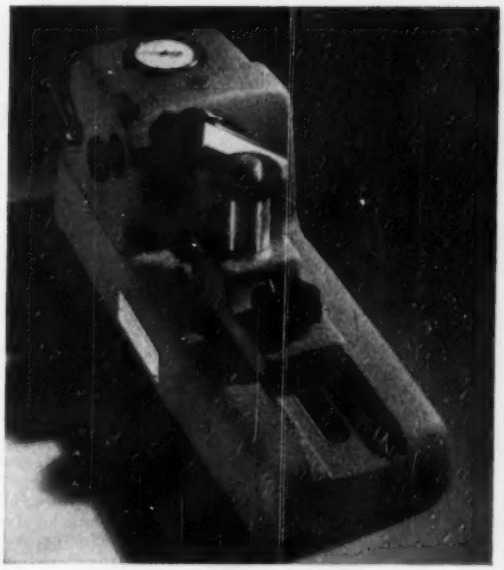

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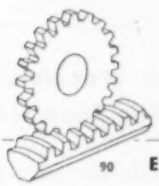

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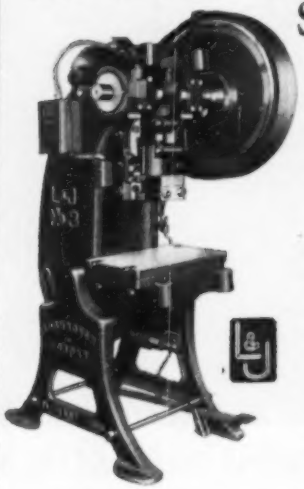

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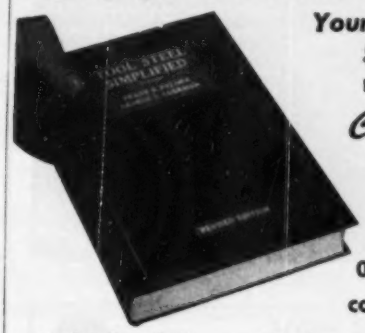

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7. The Twelve Matched Tool Steels
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Part III—Properties, Heat Treatment and Testing of Tool Steel

10. Heat Treating Methods and Equipment
11. Hardness and Toughness Testing
12. Properties and Heat Treatment of Twelve Matched Tool Steels
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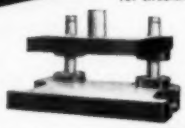

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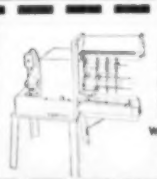

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To lower your costs on small and medium parts. Facilities for Milling, turning, boring, grinding, shaping, etc. Low rates, or we'll quote you. Sample if possible. *Write*

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FREDERICKSBURG, OHIO

MANUFACTURING FACILITIES AVAILABLE

Stampings 5 to 200 Ton—16" Stroke
Tool Room—Machine Shop
Plating—Painting—Assembly

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We have open capacity for machine work, iron castings and galvanizing. Will quote complete assemblies or parts. *Write*

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Contract Manufacturing
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PATTERNS in WOOD and METAL

For All Kinds of Castings, Large or Small
MATCH PLATE WORK A SPECIALTY
Put your pattern problems up to us — we will take care of them.

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Young, with some sales experience for Power Transmission Products to cover metropolitan New York area. Salary and commission. Give complete background and experience.

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CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

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TOOL ROOM Foreman—Excellent salary for qualified man. To take charge of modern tool room employing six men. Work includes dies, plastic molds, tools, jigs, fixtures, models and experimental machines. Should be about 35 years old with at least 10 years actual experience in this line of work. Steady habits, ability to directly and efficiently supervise are essential. Good working and living conditions in southern Minnesota city approximately 30,000 population. State full employment record and experience in detail in first letter. Also furnish photograph. All replies strictly confidential. Write to P-6510, American Machinist.

WE HAVE an opening for a machine tool designer who has had extensive experience preferably in designing machine tools. For a capable man this is a good opportunity. Give full information regarding age, salary and experience. Replies will be treated as strictly confidential. Consolidated Machine Tool Corp., 565 Blossom Road, Rochester 10, N. Y.

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SALARIED POSITIONS $3,500-$35,000. If you are considering a new connection communicate with the undersigned. We offer the original personal employment service. 40 years recognized standing and reputation. The procedure of highest ethical standards is individualized to your personal requirements and develops overtures without initiative on your part. Your identity covered and present position protected. Send only name and address for details. R. W. Bixby, Inc., 266 Dun Bldg., Buffalo 2, N. Y.

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EXECUTIVE ENGINEER desires connection with medium size company. Qualified to assume full responsibility as Plant Manager, Superintendent, Chief Engineer or Staff Assistant. 25 years of practical, design, manufacturing and sales experience in the field of automatic machinery, instruments, tools and fixtures, precision gears, refrigeration and metal stampings. Development of new products, purchasing, assembly, inspection, cost control, budget planning, Plant engineering, labor relations. Capable organizer and negotiator with excellent record to get things done. Age 47, College Graduate. M.E. PW-6640, American Machinist.

MECHANICAL ENGINEER, 32, graduate 11 yrs. wide experience machine design, dies, tools, material handling, plant layout, structural, estimating, production, operation supervision and management, seeking responsible position. PW-6711, American Machinist.

SUPERINTENDENT—SHOP Foreman. 16 years as Supervisor. Job and Production Shops, east or southern states. Knowledge of welding and electrical work. Maintenance work, precision machine work, large and small. Excellent references. PW-6787, American Machinist.

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with Shop, design, and sales experience wishes to invest $20,000 in small going business where services can be used to advantage. BO-6730, American Machinist.

PATENT ATTORNEY

Patent Practice

before U.S. Patent Office. Validity and infringement investigations and opinions. Booklet and form "Evidence of Conception" forwarded upon request. Lancaster, Allwine and Rommel, Registered Patent Attorneys, Suite 453, 815-15th Street, N.W., Washington 5, D. C.

WANTED

Plate Bending Roll—10' x 1½" in good condition.

THE LANG CO., INC.
P. O. Box 479 Salt Lake City 9, Utah

WANTED

Denver 6.2 Turret Lathes with either Side Carriage or Hexagon Turret. Will buy Hexagon Turrets separate for this model Lathe.

ROBY MACHINE WORKS
Truro, Iowa

SMALL TOOLS

½ Your Present Cost

Tool Bits ½" up, Carbide Tipped, Hi-Speed, Stellite.
H.S. Drills, Standards, Longs, Extra Long.
H S Parting Tools
Gear Hobs, Cutters, Shavers
Milling Cutters, Slitting Saws, Arbors Inserted Tooth Cutters, End Mills, Milling Clamps, Counterbores.
Taps, Reamers (Carbide Tipped, Hi-Speed)
Heavy C-Clamps, Plug Gauges, Carbide Tip Inserts.

Write for List

JOHNSON MACHINERY CO.
59 Edison Place, Newark, N. J.
Mitchell 3-7608

GRINDER, Cinc. 12x36 Univ. Hydraulic
GRINDER—DISC, Besly 218 Opp. Type 23"
LATHE—AUTOMATIC, Gisholt #12 Hydraulic
LATHE—VERTICAL TURRET, Bullard 36" Late
MULTAUMATIC, Bullard 16" 8-Spindle Std.

BRM MACHINERY CORPORATION
57-8 Edison Place
Newark 2, New Jersey

FOR SALE—ALLEN TYPE KH DRILLS

(3) ALLEN FOUR SPINDLE TYPE KH DRILLS. PRICE $1,250.00 ea.
(2) ALLEN SIX SPINDLE TYPE KH DRILLS. PRICE $1,600.00 ea.
#2 Morse Taper, ⅝" Drilling Capacity, Hand Feed to Spindle.

1942 MODELS PRACTICALLY NEW

WINSTON MACHINERY COMPANY, INC.
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MACHINERY FOR SALE
ATTENTION EXPORTERS!

Unusual opportunity to procure modern Fellows Gear Shapers 615A and 645 as well as 12" Gleason Generators, 36 BM Gould & Eberhardt Rougher, #7 Fellows Gear Shaper, #16 D. E. Whiton Machine. Write for full information.

FS-1883, AMERICAN MACHINIST
250 W. 42 St., N. Y. 18, N. Y.

LATHE—POTTER & JOHNSON 5D2E-19" Air Chucks.
HONES—BARNES Vertical, Model 172, 6" stroke.
GRINDER—BROWN & SHARPE #3 Universal
LATHE—HENDEY 16"x42" Engine, Taper Attach.
GEAR CHECKERS—ILLINOIS 514 Concentricity Measuring.

FOSTER MACHINERY SALES CO.
18800 Hawthorne TW-1-0354 Detroit 3, Mich.

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Used & Guaranteed West.—AC Transformer Type.
WT1 200 AMP., Portable, 220 Volts—$95.00.
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Also new G.E. 150 AMP. Atomic Hydrogen Arc Welder with Transformer and Auto. Head—$650.00.

B. D. BROOKS CO., INC.
Specialists in Sheet Metal Machinery
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#3 Gisholt—Preselector—Bar Feed. Late P-4
Ferracute 21½" Stk.—Motor & Controls.
Famco Power Shear—42"—18 Ga.
Keller—BG-1—Complete.

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Every Item Guaranteed as Represented

Illinois #337 Base Pitch & Space Measuring Machine. Late Type—Like New. Capacity—12" Diameter gear. 15" between centers. Full set of Off-Set and Straight Contact Fingers, Dial Indicator, Tailstocks & Leatherette Cover.

MILLING MACHINES

Multi-Miller #MM-1-6, U.S. Tool
Milwaukee #2B Dble. Overarm, Horiz.
#1M Cincinnati Horiz. Rect. Overarm.
#3 Dial Type, H.S. Cincinnati Vertical Mill.
#2, #3, #4 Cincinnati High Power Vert.
#4-36 Cincinnati 4-Spdle. Duplex Hydromatic.
#4-36 Cincinnati Plain Hydromatic.
Cincinnati #0-8 Automatic Horizontal.
Cincinnati #0-8 Vertical.
Cincinnati #2-18 Automatic Horizontal.
Brown & Sharpe #12 (Electrics Built-in) 24".
Van Norman #3V Ram Type Vertical Mill.
#4 & #5 Cincinnati High Power Horiz.
Cincinnati 24" Auto. Duplex.

LATHES

22"/46"x65"/120" Putnam Extension Bed Gap.
28"/56"x56"/114" Putnam Extension Bed Gap.
36"x30' LeBlond Q.C.G. Hvy. Duty Grd. Hd.
26"x14' Lodge & Shipley Q.C.G. Taper.
25"x14' LeBlond, Taper Att. Motorized.
24"x16' American, 11' C.C. Taper Att.
22"-46"x10' Q.C.G. Putnam Extension Bed Gap
20"x18' American Q.C.G. Grd. Hd. Taper Att.
20"x10' Hendey Q.C.G. Taper Att. Motorized.
18"x6' American Q.C.G. Grd. Hd. Taper Att.
18"x6' Monarch Q.C.G. Grd. Hd. Motorized.
16"x8' Hendey Q.C.G. Taper Att. Motorized.
14"x8' Reed-Prentice Grd. Hd. (REBUILT)
14"x6' Hendey Q.C.G. Taper Att. Motorized.
12"x6' Hendey Q.C.G. Taper Att. & Equipment.

GRINDING MACHINES

Cincinnati 6"x18" Hydraulic Cylindrical. FILMATIC BEARINGS. Built-in Controls.
Cincinnati 10"x36" Plain Hydraulic Cylindrical Model #EA. Serial #5P2D1L-19. Filmatic Bearings. Built-in Electrics. Hydraulic Infeed.
Landis 10"x32" Crankshaft Grinder.
Norton 6"x30" 'C' Hydraulic Cylind.
Norton 10"x24" Hydraulic Cylindrical.
Blanchard #16-24" Vertical Rotary.
Pratt & Whitney 22" Vertical Rotary.
Norton 6"x18" Vert. Hydraulic Surface.
Norton 6"x18" Horiz. Surface. Hydraulic.
Abrasive 22"x7"x12" Vert. Surface.
Besley #205—18" Dble. End Disc Grinder.
Cincinnati #2 Tool & Cutter Grinder.
Norton 6"x18" 'C' Hydraulic Cylinder.
Brown & Sharpe #4 Univ. Cylin. 12"x60".
Brown & Sharpe #5 Cylindrical. 3"x12".
Brown & Sharpe #13 Univ. & Tool, 8"x24".
Gallmeyer Livingston #4 Tool & Cutter.
Heald #25 Horiz. Rotary
Heald #22 Horiz. Rotary
Porter-Cable #BG-8 Belt Grinder.
Norton #2 Univ. Tool & Cutter.
Thompson 18"x6" Hydr. Surface.
Pratt Whitney 14"x36" Vert. Rotary.

BORING MILLS

3⅛" bar Giddings & L. Horiz.
5" bar Barrett #2 Cylinder. Boring.
8" bar Barrett #6 Cylinder. Boring.
Ryerson #11 Horiz. 3" Capacity, #6 M.T.
24" Bullard Vertical, 220/440 motor.
42" Bullard Vertical, 220/440 motor.
54" Bullard Vertical 220/440 motor.
42" Gisholt Vertical, 220/440 motor.
120" Niles B & Pond Vertical

UNIVERSAL MILLING MACHINES

B & S #2, 20"x5"x17½".
B & S #1½, 20"x7"x18".
Garvin #2MU, 24"x8"x18".
Kempsmith #2, 28"x8½"x18".
Cincinnati #2M, 28"x10"x18".
B & S #3, 34"x10"x21".
Cincinnati #3S 34"x12"x20".
Cincinnati #2, 28x7½x18.
Kempsmith #3, 34x10x19.
LeBlond #4 Hvy. Duty. 40x10x14.

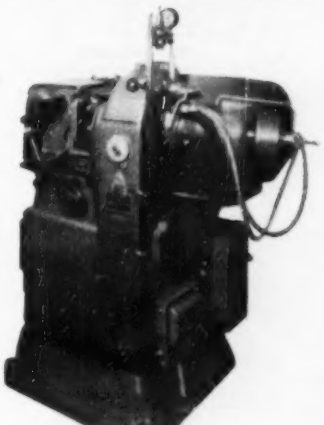
PUNCH PRESSES

8 ton Dennison Multi-Press Hydraulic.
Bliss #84 S.S.S.A. 36 tons. 10" Stroke. 20" between uprights.
Bliss #75½ S.S.S.A. 120 tons. 5½" Stroke. 24" between uprights.
O.B.I. Bliss #18, 19C, 20, 20B, 21 motorized.
#68C Bliss Dble. Action 3-Crank.
#91C Toledo Sgle. Act. Dble. Crank S.S.
#305 Bliss S.S.S.A. 95 tons Cap.
#3A Bliss S.A.S.S. Dble. Crank. 42 Tons.

PLANT LIQUIDATION
• INSPECT UNDER POWER NOW •
LATE TYPE TOOL ROOM EQUIPMENT

MONARCH #NN 36"x108" Grd. Hd. Lathe.
MONARCH #CBB 18"x96" Grd. Hd. Lathe.
MONARCH #W 16"x72" Grd. Hd. Lathe.
MONARCH #CW 16"/18½"x30" Grd. Hd. Lathe.
(10) LeBlond Regal 13"x30" Grd. Hd Lathes.
(2) LeBlond Regal 15"x42" Grd. Hd. Lathes
(2) Warner Swasey #1A Univ. Grd. Hd Turret Lathes, one chucking, one Bar Feed & Chucking.
Kearney & Trecker #3K Horizontal Mill.
Kearney & Trecker #2K Vertical Mill.
Kearney & Trecker #2 Universal Horiz. Mill.
Shields-Morey 12"x60" Thread Miller.
DO-ALL 26" Band Saw.
Racine 'Oil-Cut' 6"x6" Hack Saw.
UNIVERSAL 4" Horiz. Boring Mill, 42"x60" table. 60" Vert. Travel. 96" to outboard support.
48" Giddings & Lewis Rotary Table.
UNIVERSAL 3" Horiz. Boring Mill, 26"x58" table. 27" vert. travel. 65" to outboard support.
UNIVERSAL 3" Horiz. Boring Mill. 34"x58" table. 34" vert. travel. 96" to outboard support.
3/60/220/440 volts motors.

IMMEDIATE SHIPMENT



Gleason 3" Straight Bevel Gear Generator. Serial #18884. NEW—1942. 220/440 motors. Gear Cabinet, full set of Index Gears, Segments. Auto. Index Attachment, Pneumatic Chuck Equip. Cutter Setting Gauges & Segment Setting Gauges. Duplete Cutting Cam and Duplete Feed Cam.

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9½'11" CARLTON—motor on arm
4' 11" CARLTON
4' 11" CARLTON—3-way base
4' 11" AMERICAN "Hole Wizard"
4' 11" CINN.-BICKFORD "Super Service"
4' 11" FOSDICK "ECONOMAX"
4' 13" FOSDICK "ECONOMAX"
4' 13" CINN.-BICKFORD "Super Service"
5' 13" CARLTON D.C. Drive
6' 15" AMERICAN TRIPLE-PUR. gear box drive
6' 19" CARLTON motor on arm
6' 19" FOSDICK "ECONOMAX"
7' 19" CARLTON—motor on arm

LATHES

14"x30" LE BLOND
14"x30" BRADFORD T.A.
16"x36" LEHMANN
16"x54" MONARCH CY T.A.
16"x54" MONARCH T.A
16"x54" REED-PRENTICE T.A.
20"x48" HENDEY
20"x72" LEHMANN RAPID TRAVERSE
20"x72" LODGE & SHIPLEY
20"x72" MONARCH T.A.
20"x72" MONARCH
20"x91" AXELSON T.A.
24"x72" MONARCH T.A.
25"x72" AXELSON T.A.
27"x30" LEHMANN T.A.

GRINDERS—PLAIN CYLINDRICAL

6"x18" BROWN & SHARPE
6"x18" CINCINNATI
6"x30" NORTON
6"x30" LANDIS
10"x88" NORTON
10"x96" CINCINNATI
20"x72" LANDIS

MISC. GRINDERS

6"x18" THOMPSON TYPE F HYD. SURF.
14"x18" x36" MATTISON HYD. SURF.
No. 18 BLANCHARD 30" chuck
No. 36 HANCHETT 36" chuck 40 HP motor Rotary Surf.
No. 25A HEALD 24" chuck Rotary Surf.
No. 22 HEALD 12" chuck Rotary Surf.

BULLARD VERTICAL TURRET LATHES

24" SPIRAL DRIVE
24" RAPID PROD.
36" SPIRAL DRIVE
36" RAPID PROD.
42" SPIRAL DRIVE
42" SPIRAL DRIVE 3-Jaw chuck
54" SPIRAL DRIVE

EMERMAN MACHINERY CORP.

870 W. 120th STREET — *CHICAGO 43, ILLINOIS*

LATE MODEL MACHINE TOOLS . .

AUTOMATICS

16" Bullard Mult-Au-Matic, 6 spdl. 1941.
3½" RA-4 Acme-Gridley. 1942.
3½" Cleveland Model A. 1941.
2½" Cleveland Model A. 1943.
2½" RA-6 Acme-Gridley. 1943.
1¾" Greenlee, 6 spindle. 1942.

BOLT MACHINES

No. 5008 Manville Thread Roller. Latest.
No. 2506 Manville Header, 888D. Latest.

BORING MACHINES

62" King Vertical. 1942.
No. 2112A Jr. Excello. 1942.
47A & 48A Heald Single End. 1943.
No. 66B Heald Single End. 1940.

GEAR EQUIPMENT

No. 6 & 17 Gleason Testers. 1943.
12" Red Ring Internal Shaver. Late.
No. GCL Red Ring Shaver. 1942.
No. 624A3 Fellows Side Trimmer. New.
No. 615A3, 615A & 61A Fellows. 1944.
No. 712 & 72 Fellows Shaper. 1941.
Vinco Spline & Gear Grinder. 1942.
Red Ring Univ. Checker.

GRINDERS, CYLINDRICAL

25"x18" Landis, Crankshaft. Like New.
16"x36" Cincinnati Plain. 1942.
12"x48" Cincinnati Univ. 1943.
10"x72" Landis Plain. 1942.
10"x18" Norton Plain. 1942.

GRINDERS, INTERNAL

No. 72A3 & A5 Heald Plain. 1944.
No. 5 & 18A22 Bryant. Latest.

GRINDERS, SURFACE

No. 22 & 25A Heald Rotary. 1943.
6"x18" Norton Vertical Hyd. 1943.

LATHES, ENGINE

45"x192" Axelson. 1942.
18"x34" Lodge & Shipley. 1943.
16"x34" Springfield. 1943.
14"x30" Bradford. 1942.

LATHES, PRODUCTION

No. 3A L&S "Duomatic". 1943.
8"x108" Lo-Swing Semi. Auto. 1942.
Model 8 Sundstrand. 1942.
14"x42" Monarch "Magna-Matic". 1941.

LATHES, TURRET

42"x16" Bullard Vertical. 1943.
No. 1 & 8½"x24" Acme Univ. 1943.
No. 2 & 4 Warner & Swasey. 1943.
No. 3, 5 & 7 Barlows & Oliver. 1942.

MILLS, PLAIN

No. 5 Cin. Innati. 1943.
No. 4H & 4K Milwaukee. 1943.
No. 36 & 32 Van Norman. 1942.
No. 2HL Milwaukee. 1942.

MILLS, PRODUCTION

No. 2-24 Cin., Plain and R. & F. 1943.
No. 1-14 & 2-20 Kent Owens. 1942.
M-18 Kearney & Trecker. 1943.
No. 1224 Kearney & Trecker. 1942.
No. 3-36 Cincinnati Duplex, R. & R. 1942.
No. 3-36 Cincinnati Hydromatic. 1942.
No. 1-18, 2-18 & 2-24 Cincinnati. 1942.

MILLS, THREAD

12"x54" Lees Bradner. 1943.
6"x36" Lees Bradner. 1942.
4"x9" Hanson Whitney. 1942.

MILLS, UNIVERSAL

No. 2MH Cincinnati. 1942.
No. 2H Milwaukee. 1942.
No. 2SU Van Norman. 1942.

MILLS, VERTICAL

No. 3B P&W Univ. Die Sinker. 1943.
No. 2K & 2H Milwaukee. 1942.
No. 2 & 3 Cincinnati. 1942.
No. 1 Cleveland. 1942.

PRESSES

100 Ton Hannifin, Hyd., Str. 1942.
50 Ton Denison, Hyd. Str. 1942.

SHAPERS

20" Cincinnati Plain. Late.
25" Smith & Mills Univ. 1945.

Write for latest stock list

INDIANAPOLIS *Machinery & Supply Co.*
1961 S. Meridian St. . . Indianapolis, Indiana

UNUSUAL VALUES

Milling Machines—No. 1 Universal, No. 1 American (new) plain, No. 1 Vertical.

Drills—Large selection, single and multiple spindles also bench types, many of them new.

Gear Cutters—Brown & Sharpe No. 3—26" Gould & Eberhardt 42".

Grinders—Cylindrical B & S No. 11, Planer type 16"x36" Surface 13"x63", also new (small) Universal bench and floor type. All with coolant, motorized.

Lathes—14"x8', 8', 10'—16"x6', 8', 10'—18"x8', 10'—26"x16'—all cone drive, several motorized also (new) 18"x8' and 10' geared head, motorized.
Large stock 19" and 18" bench and floor type.

Planers—Single head 24"x6', 24"x8', 28"x8'.

Shapers—16", 20", 24" B.G. crank.

Turret Lathes—J & L 2"x24"—3"x36" also Asme, W & S Turret (vertical) boring and facing mills, 5 hole turrets, 30", 40".

SPECIAL—New totally enclosed dust proof, fan cooled ball bearing saw arbor motors, plain shafts to size or threaded, and with collars, measures only 3¾" from center of shaft to flatted nip (1 h.p. to 15 h.p.) 2 or 3 phase, 3600 r.p.m.

WOOD WORKING MACHINERY—A very large stock of new and re-built, practically all motorized. New Motorized overhead cut-off and miter saw for wood, plastics, steel, aluminum and other metals. The above list is only a fraction of our stock which changes almost daily, therefore, tell us definitely what you want since we are adding considerable number of machines to our stock which are too many to list. What we have today may be sold tomorrow, so a list is really not dependable.

Drill—Foote-Burt No. 25 24" Hi Duty 3" capacity in steel. Motor attached.

PATTERN MAKING MACHINERY—42"x16' bed wood lathe, compound rest, rack and pinion feed to carriage; 16" heavy duty jointer, extra long bed, front table tilts for giving draft to pattern work; tilting table also tilting arbor rip and cut-off saws; band saws; jointer; floor and bench type trimmers; and also many other machines for pattern work.

THE OSBORNE & SEXTON MACHINERY CO.

P. O. Box 88 Columbus 16, Ohio

LATEST TYPE *Nearly New* MACHINES

BORING MILLS—Horizontal
DEFIANCE 2½" bar, Latest Type
DEFIANCE 3½" bar, Latest Type
DETRICK & HARVEY 3" bar, Floor Type, M.D.
GIDDINGS & LEWIS #25T, 2½" bar, Latest Type
HEALD 48A, 49 single end, Borematic, Latest
LANDIS—#35—5¼" bar, floor type, M.D.
LUCAS #41, 3" bar, Table Type, Late Type
LUCAS #43, 3½" bar, Table Type, Late Type
NILES-BEMENT-POND 5", 8" bar, Floor Type, M.D.
UNIVERSAL 3" bar, high speed, latest type

BORING MILLS—Vertical
BULLARD 24", 36" Turret "New Era" Side Head, M.D.
BULLARD 24", 36", 42" Vert. Turret "Spiral Drive"
High Speed, Latest Type
BULLARD 30" "Cutmaster", Latest Type
BULLARD 64" "Cutmaster", Latest Type
COLBURN 72", 2 swivel heads, PRT, M.D.
NILES 100", 2 swivel heads, Rapid Traverse, AC M.D.

DRILLS—Miscellaneous
BARNES H-3 "Hydram" Hydraulic, 3" capacity—for inverted drilling, Latest Type
LELAND & GIFFORD #21LMS, 4 Spindle, Latest Type
LELAND & GIFFORD #2—2, #2MS Single Bodie
LELAND & GIFFORD #3 LMS 6 spindle, Latest Type
NATCO #4AL Multiple, 30 spindles, Hyd., Latest Type

GEAR CUTTING EQUIPMENT
BARBER COLMAN Type A Hobber, Latest
BARBER COLMAN #12 Hobber, Single and Double Overarm, Motor Drive
BILGRAM 6" and 16" cap., Bevel Gear Gen., M.D.
BROWN & SHARPE #13 Spur and Bevel Cutter, M.D.
BROWN & SHARPE Rounding Machine, Motor Drive
CROSS #1 Tooth Rounding Machine, Motor Drive
CROSS #30 Gear Chamferer, Latest Type
FELLOWS 6A Model 61, 81A, 6E2, 7A, 72, 725, 77
High Speed Gear Shaper, Latest Type
FELLOWS #123M Involute Measuring Instrument, latest
FELLOWS #12LS Lapper, latest type
FELLOWS 8M Red Liner, Latest Type
FELLOWS 8M Hypoid Spiral Grinder, Latest Type
GLEASON #14 Hypoid Spiral generator, latest type
GLEASON 3", 12" straight bevel generator, Latest Type
GLEASON #4, #6, #18 Bevel and Hypoid Tester
GLEASON #16 Hypoid Generator, Latest Type
GLEASON 24", 31", 72", 90" Straight and Bevel Gear Planer, Motor drive
GOULD & EBERHARDT 12H Hobber, DIFF., Latest
GOULD & EBERHARDT 18H Hobber, Motor Drive
GOULD & EBERHARDT 96H Hobber, with diff. M.D.
GOULD & EBERHARDT 9H Hobber, with Infeed and Differential, Motor Drive
NEWARK #5, 72" Hobber with Infeed and Differential, Motor Drive
PRATT & WHITNEY 10" Grinder, hyd., latest
SCHUCHARDT & SCHUTTE #1 Hobber, Motor Drive

GRINDERS—Cyl.—Plain & Univ.
BROWN & SHARPE #2, 2, 3, 4, Universal, Latest
BROWN & SHARPE #5 Plain, 3 x 13, Latest Type
CINCINNATI 12"x48" Univ., Model EE, Latest Type
CINCINNATI 16"x36" Model E.E., Univ., Latest Type
LANDIS 4x12, Type H, Plain Hyd., Latest Type
LANDIS 6"x18" Type C Plain, Hyd., Latest Type
LANDIS 20"x120" Plain Roll, Motor Drive
NORTON 6"x18", 6"x36", 14"x26", 16"x72" Type C. Plain, Latest Type

GRINDERS—Miscellaneous
BARBER COLMAN #3, #4 Hob Sharpener, Latest
BROWN & SHARPE No. 13 Universal Cutter & Tool, Lat.
BRYANT #3, #6, 16-C-16, 16-CF-16, 24-36" Internal, Hydraulic, Latest Type
CINCINNATI "Monoset" Tool & Cutt., Latest
FITCHBURG 14"x25" Spline hydraulic, latest
GARDNER 24-53" Disc Grinder, Latest
GLEASON #12 tool sharpener, Latest Type
HEALD 72A3, 72A5 "Gagematic" Internal, Latest
HEALD 72A3, 72A5, 74 Internal, latest type
HEALD #81 Internal Sizematic, Latest Type
HEALD #81 Internal, Centerless, Sizematic and Gagematic, Latest Type
KEARNEY & TRECKER Face Mill Grinder, Latest type
LANDIS #6, 6x24 Thread, Latest Type
LE POINTE 60" Universal Broach Sharpener, Latest
THOMPSON 6"x48" Auto. round broach M.D.
VAN NORMAN #639, #73 Osc. Radius Grinder, Latest
VAN NORMAN #666 Crankshaft ReGrinder, Latest

GRINDERS—Surface
ABRASIVE 3B, 8"x24" Hyd., Latest Type
BLANCHARD #11, 16" dia. mag. chuck, Latest
BLANCHARD #16, 24" dia. mag. chuck, Motor Drive
BLANCHARD 16A Vertical Dial Feed, Motor Drive
BLANCHETT Series 300 12"x48" Vert. Hyd., Latest
HANCHETT #26 Vert. 30" dia. mak. chuck, Latest
HANCHETT #120 30x120" Plano, Hyd., Horiz. Latest
HANCHETT #121 30x120" Plano, Hyd., Horiz. Latest
HEALD #22 Rotary, 12" chuck, latest type
HEALD 25A—rotary—16", 24", 20" chuck, Hyd., Latest
NORTON 6x18 Hydraulic, latest type

JIG BORERS
KEARNEY & TRECKER Model B Autometric, Latest
PRATT & WHITNEY 1A, Motor Drive
SOCIETE GENEVOISE (SIFP) #4 Precision, Table 19"x27", Motor Drive

LATHES—Engine and Mfg.
AMERICAN 26"x360 centers, 2 carriages, motor drive
JONES & LAMSON "FAY" 20"x20" Automatic, Latest
JONES & LAMSON "FAY" 20"x25", Automatic, Latest
JONES & LAMSON "FAY" 24"x24" Automatic, Latest
JONES & LAMSON "FAY" 24"x24" Automatic, Latest
LeBLOND 21"x96" Centers, Geared Motor Drive
LEHMANN 16x30" Centers, TIMKEN, latest type
LODGE & SHIPLEY 16"x30", 14"x30" Timken, Latest
LODGE & SHIPLEY 18x72 centers, M.D.
LODGE & SHIPLEY 18x72 centers, 5x36, Latest
LoSWING 4x60, 4x84, 8x60, 8x108, 5x36, Latest
MONARCH 10"x20" centers, Model EE, Timken, late
MONARCH 12"x30" Centers Model CKK, Timken, latest
MONARCH 12"x54" Centers, Model CK, Timken, latest
MONARCH 12"x54" Centers, Geared Head, M.D.
MONARCH 24"x54" Ball Bearing, Model CM, Timken
MONARCH 22"x192" Centers, Model CM, Timken

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Your best buy is a Morey NEARLY NEW machines for these reasons:
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NILES 30"x50" Boring "Time Saver" Timken, Latest
PRATT & WHITNEY 16"x30" Centers, Timken, Latest
PRATT & WHITNEY 16"x30" centers, Bench, latest
PRATT & WHITNEY Centers, Motor Drive
PUTNAM 42"x22" Centers, Model A, Latest
REED PRENTICE 20"x54" Centers, Timken, latest type
SPRINGFIELD 16"x30" centers, Timken, latest type
WARD, HAGGAS & SMITH—18/30x60" centers gap. motor drive, Latest Type

LATHES—Hob and Cutter Relieving
CLEVELAND 12"x16" Centers, Cutter, Motor Drive
MICHIGAN 1712 Universal, Latest Type
U. S. Tool #310B, 8"x15" Centers, Cutter, Latest

LATHES—Turret
BARDONS & OLIVER #5, #7, TIMKEN, Latest Type
CINCINNATI ACME No. 1 Timken, Latest
FOSTER #4FU "Fastermatic," Timken, Latest
GISHOLT #1L, #3L, #3L Universal, Timken, Latest
GISHOLT #3, #4 Univ., Timken, Latest Type
JONES & LAMSON #3 Univ., Timken, Latest
LIBBY "Internationa," 1H5 Univ., Timken Bearing, latest
MOREY No. 2G, No. 3, No. 4 Timken Bearing, Latest
POTTER & JOHNSTON #5DK, Timken, Latest
WARNER & SWASEY 5, Universal, Timken Bearing
WARNER & SWASEY #3, Timken, Latest Type
WARNER & SWASEY 3A Universal, Timken Bearing
WARNER & SWASEY 3A Universal, Timken Bearing Bar and Chucking, Latest Type
WARNER & SWASEY 3A Universal, Timken Bearing Bar and Chucking, Latest Type

MILLING MACHINES—Mfg.
GRAY 84"x52"x16" Planer Miller, 3 heads, Latest Type
HALL Style L, Planetary, latest type
INGERSOLL 42"x30"x12" adj. rail, 4 heads, AC, M.D.
INGERSOLL 42"x30"x12" Planer Type 2 heads, AC, M.D.
INGERSOLL 32x24x16" Planer Type 2 heads, AC, M.D.
INGERSOLL 30x24x12" adj. rail slab, M.D.
SUNDSTRAND Model 3A Duplex 42" feed, Latest
SUNDSTRAND Model 3A Duplex Spline, latest
TAYLOR & FENN M80 Duplex Spline, latest

MILLING MACHINES—Plain
BROWN & SHARPE #2, Light Type, Timken, Latest
BROWN & SHARPE #12, 24" feed, Latest Type
BROWN & SHARPE #00, Timken, Latest Type
BROWN & SHARPE #2B, 3B, Timken, Latest Type
BROWN & SHARPE #2B, 3B Automatic, Latest Type
CINCINNATI 0-1, 1-12, 2-18 Automatic, Latest Type
CINCINNATI #2, #4, #5 High Power, Late Type

KEARNEY & TRECKER (MILWAUKEE) 3H Vertical Milling Machine—Size of table—64" x 13½"; Longitudinal feed—34". Timken Bearing, Latest Type

CINCINNATI 4-36 Hydromatic, Simplex, Latest Type
KEARNEY & TRECKER #2H, 3H, 4H, 5H, Latest
KEARNEY & TRECKER 1218, 1404, Simplex, Latest
KEMPSMITH #3G, #4 Timken, Latest Type
KEARNEY & TRECKER 4K, Timken, Late

MILLING MACHINES—Thread
LEES BRADNER Model LT, 6"x36" Centers, Latest
LEES BRADNER Model HT, 12"x54" Centers, Latest
LEES BRADNER Model HT, 12"x54" centers, Latest Type
MOREY 12x36" 60°, 120°, 180° centers, Latest Type
PRATT & WHITNEY 6x36" Model C, Latest Type
PRATT & WHITNEY 6x36" Model C, Latest Type

MILLING MACHINES—Universal
BROWN & SHARPE No. 2A Timken Bearing, Latest
BROWN & SHARPE No. 2A, 4A, Motor Drive
BROWN & SHARPE No. 2A, Timken, Latest Type
CINCINNATI #2MH, Timken, Latest Type
KEARNEY & TRECKER 2H, Timken, latest type
KEARNEY & TRECKER 3H, Timken, Latest Type
KEMPSMITH #4 Maxi-miller, Timken, latest type
VAN NORMAN #2 duplex, Motor Drive
VAN NORMAN #26, #36, Timken, Latest Type

MILLING MACHINES—Vertical
BROWN & SHARPE #2 Standard Timken, Latest
BROWN & SHARPE #2 High Speed, Latest
CINCINNATI #2H TIMKEN, Latest Type
CINCINNATI #00 Timken, Latest Type
GORTON 6D, 9-4D Super-Speed, Latest Type
KEARNEY & TRECKER 2H, 3H Timken, Latest
KEARNEY & TRECKER Double Spindle Profiler, Latest
MOREY 12M Single & Twin, with or without hydraulic duplicator, Timken bearing, Latest Type
REED PRENTICE 3VG, with or without hydraulic duplicator, Timken bearing, Latest Type

PLANERS
BETTS (CONSOLIDATED) 24"x22"x16' 4 heads, Box Table, Rapid Traverse, D.C. M.D., Late Type
BETTS (CONSOLIDATED) 108"x84"x36' 4 heads, Box Table, Rapid Traverse, D.C., M.D., Late Type
CINCINNATI 36"x30"x72", 4 heads, PRT, DC, M.D.
CLEVELAND 48"x48"x12" Openside, Motor Drive
DETRICK & HARVEY 48"x48"x16' 4 heads, Hydraulic Rapid Traverse, A.C. Motor Drive
NILES 108"x84"x12' 4 heads, Box Table, Rapid Traverse, D.C. M.D., Late Type
NILES 48"x48"x12' Time Saver", Box Table, 3 heads, D.C. reversing motor, Latest Type
NILES 42"x42"x16' "Time Saver" Box Table, 3 heads, D.C. reversing motor, Latest Type
NILES 42"x42"x16' "Time Saver" Box Table, PRT, V-KAR-VOLTAGE Drive, Latest
NILES 96"x96"x24' 4 heads, Rapid Traverse, Box Table, D.C. reversing motor drive

PRESSES
BIRDSBORO 325 ton, vert. hyd., Latest Type
BLISS 325 Hydro-Dynamic, Double Action, Latest
CLEARING K-1200-30 Knuckle Joint, 200 ton, 4" stroke, Latest Type
GLEASON 150 Quenching, Hyd. Motor Drive
LAKE ERIE 500 ton Vert. Hyd., Latest Type
TOLEDO #23A, 88 ton geared, Motor Drive
NIAGARA #38B, 98 ton geared, Motor Drive

SCREW MACHINES—Automatic
CLEVELAND 9/16", 1-1/16" Model A, Latest Type
CONOMATIC 2½"—6 spindle, high speed, Latest Type
GOSS & DeLEEUW 7½"—6 spindle Chucker, Latest
GOSS & DeLEEUW 6" 5 spindle Chucker, Work Rotating, Latest Type

SHAPERS & SLOTTERS
AMERICAN 20" Heavy Duty, Motor Drive
CINCINNATI 20" High Speed, Latest Type
DILL 20" Vertical, Motor Drive
LAMAIRE 18" Vertical, Hydraulic, Latest Type

SHEARS—Power
QUICKWORK #5, ¾" Cap., Rotary Shear, M.D.
QUICKWORK #6, 1" Cap., Rotary Shear, M.D.
WYSONG & MILES #572, 14 gauge x 6' Latest Type

MISCELLANEOUS
AJAX 3½" Forging and Upsetting, M.D.
BAKER #75 Keyseater Motor Drive
BARNES #172, 306H, 307, 307B Vertical Hone, Hyd.,
Self Oiling, Latest Type
CAMPBELL, #1401 Abrasive Saw, Latest Type
DE LAVAL #194 Coolant Clarifier, Latest
FOSTER 4"x18", 4"x36" Superfinisher, Latest
HELLER Model 8S-1 Cold Saw, 8" cap., M.D.
LANDIS 2 Single Spdle. Bolt Threader, M.D.
NAZEL, #4B Pneumatic Hack Saw
PEERLESS 14"x16" Hydraulic (KELLER) Type BL-2416.
PRATT & WHITNEY Type G, Coupling 2 and 3 dimensional, Latest Type
ROWBOTTOM Cam Miller, Motor Drive
STURDYBENDER 5/16"x6' Power Press Brake, Latest

WATCH THIS PAGE

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90% of the following machines manufactured since 1941

AUTOMATICS
Acme-Gridley 5 1/8" RA-6 Spindle
Acme-Gridley 2½" RA-6 Spindle
Brown & Sharpe #2G Screw Machines
Cleveland 4" S.S. Model "A"
Cleveland 2½" S.S. Model "A"
Gosa & DeLeeuw 0x6¼" 5-Spindle

BORING MILLS
Betts 6" Floor Type Horizontal
Bullard 61" Vertical Boring Mill (Maxi-Mill)
Cincinnati 64" Vertical Boring Mill
Heald 48-A Bore-Matic
Niles 100" Vertical Boring Mill

DRILLS & RADIALS
Allen 6-Spindle Drill Press
American 4'11" Radial Drill
Avey #3 S.S. Drill Press
Baker #60 12-Spindle HO Drill
Edlund 4-Spindle Drill
Foolok #5BM S.S. Drill

GRINDERS
Arter A1-12" Rotary Surface Grinder
Brown & Sharpe #1 Universal Grinder
Brown & Sharpe #5 Cyl. Grinder
Brown & Sharpe #22, 10x36" Cyl. Gr.
Cincinnati 6x18" Plain Cylindrical Gr.
Cincinnati #2 Centerless Grinder
Cincinnati Monoset Cutter Grinder
Cincinnati #2 Tool & Cutter Grinder
Covel No. 15 Surface Grinder
Covel No. 91-A Univ. Tool & Cutter Gr.
Ex-Cell-O No. 31 Plain Thread Grinder
Hammond #8, Type B Carbide Tool Grinder
Hammond Model #10 D.E. Grinder
Heald #22—12" Rotary Surface Grinders
Heald #72-A Internal Grinders
Heald #81 Gagematic—Sizomatic Grinders
Hill-Acme 18x30" Surface Grinder
Jones & Lamson 6"x30" Thread Grinder
Landis 6x10", Type "C" Plain Grinder
Landis 10x10" Grinder
LeBlond #2 Tool & Cutter Grinder
Norton 10x30", 45° Cylindrical Grinder
Van Norman 20x48" Crankshaft Re-Grinder

SAWS
Cochrane-Bly #55 Cold Saw
Do-All V-16 Band Saw
Higley 8" Cold Saw
Moteh & Merryweather #3 Cold Saw
Racine 8"x0" Hacksaw

LATHES
American 20"x8' Engine Lathe
American 24"x7' Engine Lathe
Gardons & Oliver #5 Turret Lathe
Betts-Bridgeford 36"x8' Centers Lathes
Boye & Emmes 24"x8' Lathe
Bradford 16"x84" (8' Bed) Lathe
Gardner No. 3 Plain Polishing Lathe
Gisholt #5 Turret Lathe
Hendey 24"x22" B. C. Lathe
Jones & Lamson #5 Turret Lathes
LeBlond 21"x7' Engine Lathe
Lodge & Shipley #3A Duomatic Lathe
Lodge & Shipley 12"x36" Engine Lathe
Lodge & Shipley 20" Lathe
Logan Model #200, 10x24" Lathe
Monarch 14"x30", Type "60" Tool Room
Reed-Prentice 14x30" (6' Bed) Lathe
Warner & Swasey #3A Turret Lathes
Warner & Swasey #4 Univ. Turret Lathe, Bar Feed & Chucking
Wicks 36x16' Bed Engine Lathe

MILLS
Cincinnati #2 Horizontal Mill
Cincinnati 24" Duplex Mill
Cincinnati 1-16 Climb Mill
Cincinnati 2-10 Production Mills
Cincinnati 2-24 Mill
Cincinnati 3-24 Hydromatic Mill
Cincinnati 3-26 Hydromatic Mill
Cincinnati #3 Plain M.S.D.T. Horizontal

Acme-Gridley 3½" RA-6 Spindle

Bullard 42" Vertical Boring Mill

Kearney & Trecker #4K Horizontal Mill

Hardinge Vert. & Horiz. Mills
Index 22x8" Milling Machine
Kearney & Trecker #2 Special Mill
Kent-Owens #1M Hand Mills
Lees-Bradner 12x36" Thread Mills
Products Model "M" Hand Mill
Van Norman #2BU Universal Mill

SHAPERS
Fellows #61 Gear Shaper
Pratt & Whitney 6" Vertical Shaper
Smith & Mills 10" Horiz. Shapers

PRESSES
Bliss #303½ S.S. 35-Ton Punch Press
Ferracute 100 Ton S.S. Punch Press
HPM 100 and 150 Ton Hydraulic Presses
Standard #3 Screw Press (Arbor Press)
Toledo #41 Horning & Wiring Press

MISCELLANEOUS
Acme 2" Hot Header
Airo #10 Pantograph
Ajax 2" Header (Upsetter)
Bakewell #1 Tapping Machine
Chicago #916, 8' 10 ga. Bending Brake
Centrifugal Extractor, 28" (Chip Wringer)
Cincinnati 2-48 Duplex Vertical Broach
Detroit Tap Sharpener
Elwell-Parker Type GEP-6 Gasoline Lift Truck
Elwell-Parker Boom Crane
Es-Cell-O #28A Hydraulic Drill Heads (2)

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10"x24" LANDIS TYPE "C" HYDRAULIC UNIVERSAL GRINDER, A.C. motor driven. New in 1943. Excellent condition $2475.00

#2 CINCINNATI HIGH SPEED DIAL TYPE UNIVERSAL MILLING MACHINE, A.C. M.D., spindle speeds to 1500 RPM, dividing head, arbor, brace arms, pump and coolant piping. NEW 1943—Ready to operate $5850.00

No. 4-L GISHOLT HEAVY DUTY SADDLE TYPE TURRET LATHE, 25 H.P. A.C. motor driven, 9¼" hollow spindle, hardened ways, *with threading attachment*, 24" steel 4-jaw chuck. NEW 1940. Excellent. $5750.00

42" BULLARD "NEW ERA" VERTICAL TURRET LATHE, A.C. 3 phase motor driven, power rapid traverse, with chuck jaws. In first-class condition $4250.00

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LATHE — Engine, Mack. Hemphill 72"/96" x 30" centers (1943)

HYDROTEL—Cinc. Vert. Miller, 28"x60", 4 Spindles, 360° Automatic Tracer (1942)
MILLER—Hor. Plain, K. & T. No. 4K (Late)
PLANER—N.B.P., 48"x48"x26', 4 Heads
PUNCH—Beatty No. 7—1¼" thru 1" (1947)
BORING MILL—D. & H. 3½" Floor (Bargain)
ROLLS—Bending—H. & J. 30"x¾" Pyr. Southwark 15"x3" Pyr., Vertical
ROLLS—Angle—Bertsch 3"x3"x⅜"
SHEAR-ALLIGATOR—(#2) 24" Blade, 3" Rds., etc.
SLOTTER—Newton 24"x42" Table. (Rebuilt).
THREAD MILL—Morey 12"x10' centers (1942).
PRESSES—Bliss #20—30 Ton, OBI
Z & H #7—50 Ton, Percussion
Bliss #6—125 Ton (Late)
Clearing—200 Ton, 30" Stroke
Bliss #310—450 Ton, 18" Stroke
Hydraulic Presses—375, 500, 675, 750, 3,000 Tons (Late)

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DYNAMOMETER FOR SALE
900 HP Midwest Dynamatic Dynamometer, 250 Volts, 1500—3500 RPM, Type 2025-W, serial No. 2200 Unused. W/Toledo Scale, controls, etc.
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AUTOMATICS
Brown & Sharpe, Nos. 00G, CECO ⅜", Swiss Type
Fay Automatic, 12"x81".
New Britain No. 61—2¼" 6 spd.
Peterman #1 Swiss, 5/16" cap.

BORING MILLS
Giddings & Lewis No. 0, No. 25T.
Lucas No. 31, horiz.
Heald #49 double spindle, #48A
Universal 3" horiz. equipped.
Bullard 24", 36", 42" VTL
King 72" vertical

DRILLS AND RADIALS
Barnes No. 242, No. 5 Morse
Carlton 8'-19" column
Canedy-Otto 3'-9" col.
Sibley 24"-28", Power Feeds
Hamilton, Langelier, Hi-Speed.

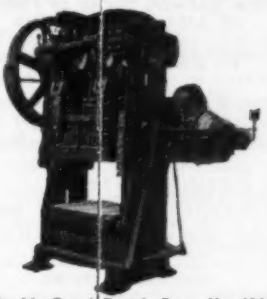
ENGRAVERS
Gorton No. 3U, 2 dimen.
Deckel GK1, & GIL, 3 dimen.
Gorton Cutter Grinders 375-2, 268-6.

GEAR EQUIPMENT
Barber Colman No. 3 Precision
Fellows #7, 72, 712, 725, 7125, High Speed.
Fellows 644Y Spur & Spiral
Gleason #2 Surface Hardener.
Gleason 3" Spur Bevel Generator
Hamilton Hobber #00
Michigan, Gleason, Fellows Checkers.
Mikron Gear Hobber.

GRINDERS, MISCELLANEOUS
Brown & Sharpe No. 5 cyl. 3" x 18", 3" x 12".
B. & S. Nos. 1, 2, 3 Univ.
B. & S. No. 13 Univ. & Tool.
Cinc. No. 2 Centerless Filmatic.
Cinn. 12 x 48" Filmatic Univ.
Cinn. #2 Univ. Tool & Cutter
Covel No. 91A Univ. T. & C.
Dalzen Thread, latest
Gardner #226, 30" Disc.
Hanchett #228 Disc. Dbl. opposed w. M.D. Feed.
Heald 72A3 Sizematic Int. Centerless.
Jones & Lamson Thread, Univ. TG636
K.O. Lee Tool & Cutter.
Landis Centerless.
Landis No. 4H Cyl. 4 x 12", No. 6 Thread, 10 x 36" angu.
Norton No. 2 Tool & Cutter, Hyd.
Oliver 510 Drill Grinder, Sellers 4G Drill Grinder

GRINDERS, SURFACE
Abrasive #3B, 6"x24" cap.
Abrasive No. 33, 34 Vert., 8x24.
Blanchard No. 11, 16" Mag. Chuck.
Blanchard #16A—30" Chuck
Blanchard #18 30" Chuck
G & L Hyd. #25, 6x18", #35, 8x24", #45, 12x24".
Hanchett Model 300, 13 x 48".
Heald #28A Rot. Surf 16" hyd.
Norton 6x18", and 10x36" Hyd.
Reid No. 2A P.F. MIB.
Reid No. 2C Motor Spdl. Hand Feed.
Thompson Hyd. 6 x 10 x 18", 6 x 12 x 18".

LATHES
Bradford 14"x6', G.H. Latest Sebastion 12"x4'
Hardinge Precision, 1" Collet Cap., Rivett. Precision.



Bliss Double Crank Toggle Press No. 406—48"

Bliss #3½A Toggle Press Geared.
Bliss No. 304A, 306 Straight Side Presses.
Bliss #8—Bed 42x96"—250 Ton.
Bliss 645B, 650 High Production Presses.
Henry & Wright 25 and 75 Ton Dieing Presses.

HYDRAULIC PRESSES

DOWN MOVING RAM, SELF CONTAINED

MANUFACTURER	TON CAP.	STR.	OPENING	PLATEN
Lake Erie	500	36"	68½	35 x 36
H.P.M. Double Action	500	24"	30"	36 x 36
Watson Stillman Shaft Straightener	500	24"	57"	24' bed.
Denison	25/50	18"	23"	22 x 20
Hannifin	50"	20"	30"	22 x 30
Southwark, D. A. Clamping Plate	125	30"	2' to 4'	84 x 30
Oilgear Shaft Straightener	35	8"	12"	84 x 11

DOWN MOVING RAM, WITHOUT POWER UNIT

Mesta	750	42"	80"	44 x 44
Chambersburg	300	16"	27"	22 x 36
Southwark	350	42"	78"	28 x 48
Southwark	550	23"	68½"	42 x 32

UP MOVING RAM PRESSES

Southwark	600	28"	27" to 48"	36 x 24
Waterbury Farrel	800	6½"	28"	22 x 24
Birdsboro	800	20"	30" to 48"	40 x 32
Watson Stillman	300	12"	21"	24 x 20
Watson Stillman	300	12"	19"	20 x 20
Watson Stillman (Hob) New and Used	300	6"	32"	16 x 16
HPM	180	15"	14½"	30 x 30
Dunning & Boschert Molding Press	300	12"	38"	24 x 32 Mold
Stokes Molding Press and Pump	100	7"	24"	22 x 15
Stokes Molding Press and Pump	150	8"	31"	24 x 23
Elmes—With Elec. Plates	50	6"	12"	18 x 18
Stewart Boling	95	10"	19"	20 x 20

WHEEL PRESSES
NILES — 600 ton 96"; 500 ton — 48"; 300 ton — 48".

INJECTION MOLDERS

ACCUMULATORS

Mfr.	Size	Pounds
HPM	4" x 9"	2000
General Electric	15" x 11"	400
Watson Stillman (13 gal) Hydr. Pass.	42 x 9 x 48"	3000

Hendey G.H. 16x30", Rel. Att.
LeBlond Regal 10"x24½", 13"x24", 15"x30", 15"x48" TA, 19"x48" TA, 21"x60"
LeBlond Heavy duty 16"x30".
Lodge & Shipley 16 x 78" T.A., Collets, etc., and 20" x 84" equipped
Monarch 10"x20" EE.
Monarch 12x30" Dble. Compound, swings 18"
South Bend Q.C.G., 13"x6', 16"x4', 14½"x6'.

MILLS, PRODUCTION
Brown & Sharpe, No. 000, 12, 21.
Cincinnati No. 1-12, 1-18, 2-16 Mfg., 50-96 hydromatic
U. S. Multimiller, 1 and 2 Spindles.
Sundstrand 00 Rigidmills, Kent Owens IV.

MILLS, PLAIN AND UNIVERSAL
B. & S. No. 2B Pl., No. 2A Univ.
Cincinnati No. 3 Plain.
Cincinnati No. 2MH Univ., H.S.
Milwaukee 2HL, 2H Univ., H.S.
Milwaukee No. 2M Plain.
Van Norman Duplex, 12, 20, 22L, 36.

MILLS, VERTICAL
Index, Jackson
Brown & Sharpe No. 2 Standard.
Cincinnati No. 4, Hi-Power.
Gorton No. 3D, 5J Plain.
Morey No. 12M Profiler 2 sp.
Sipp MP5 Jig Borer.

PRESSES
Bliss No. 18, 19, 20, OBI.
Bliss No. 304A, 4" Str. 23"x24" bed, #306 w. Air Cushion.
Bliss No. 645B, 650 Hi-Production, 58, 62, 62A, 162.
Bliss No. 8 42"x96", 250 Ton
Bliss No. 4½ Double Action Cam Gen. flexible Screw Press.
Henry & Wright Dieing, 25 Ton, 75 Ton.
L & J #2, 4, O.B.I.
Reliance 45 Ton, O.B.I.
Z. & H. 50 Ton, O.B.I.
Stokes Tablet Presses, Model R & T, DD2, & Colton Tablet Presses.

TURRET LATHES
Acme No. 4W, 6W Bar and Chuck, Acme Fox.
Bardons & Oliver No. 3, 1½" cap., No. 5, Chuck.
Brown & Sharpe No. 1, 2F
Foster No. 3B.
Gisholt No. 4, 5 Bar and Chuck, 2L, Saddle Type
Jones & Lamson #5 Univ. Preselector head.
Warner & Swasey No. 3, 5, Preselector, No. 4A 8" Cap.

MISCELLANEOUS
Band Saw: Tannewitz No. 26M.
Beading Roll: Buffalo No. 0, Buffalo Wrapping Roll No. ½.
Broach: American Horiz. Hyd. H-15-60.
Hacksaw: Marvel Nos. 6 and 6A Automatic Feed.
Marking Machine: Noble & Westbrook
Notching Press: Ferracute C82.
Pin Machine: Nilson.
Shaper: Sheldon 12" Brand New 24" Rockford Hyd. Heavy Duty.
Honer: Micromatic Hydrohoner, Sunnen.
Keyseaters: Mitts & Merrill, Baker, Burr, Davis.
Rivet Hammers: Hi Speed, Chic. Pneumatic.
Toolmakers Microscope: Gaertner, Bausch & Lomb, Leitz
Router: #55 Oliver.
Tapper: Bakewell #1, #3G, Haskins 3C.
Haskins No. 3C, 3CAM.
Welders: Spot & Seam: Thompson, Taylor, Winfield.

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CINCINNATI: #2M Vertical, Rotary table
CINCINNATI: 0-8 Vertical
SUNDSTRAND: 96 Rigidmil—Duplex (For milling cam tracks in propeller hubs or similar work)
SUNDSTRAND: #00 Rigidmil—Hydr.
BRIDGEPORT: Vertical, Turret
MOREY: 12M 2-spindle Profiler
TAYLOR-FENN: M-80 Duplex Spline
TAYLOR-FENN: Vertical
RICE-BARTON: Duplex Spline

THREAD MILLERS & TAPPERS

HANSON-WHITNEY: 9"x10" Thread
MOREY: 12"x20" Thread Miller
LEES BRADNER: 40A Thread Miller
HALL PLANETARY: B & C Thread Millers
MURCHEY: #22 Tapper, Horiz.
PRODUCTO: Hand Tapper

TOOL SHARPENERS

OLIVER: 2A Face Mill
OLIVER: 510 Drill Pointer
OLIVER: 10" Tool Bit—Template
FELLOWS: Flat Top Helical Gear Cutter
NIFE: Univ. Tool & Cutter (New)

GRINDERS—THREAD

EXCELLO: #31 & #33 Ext.
JONES & LAMSON: TG-636 Ext.

GRINDERS—CYLINDRICAL

LANDIS: 10"x10" "C" Plain Hydr.
LANDIS: 10"x32" Type "D" Crankpin, Hydr.
CINCINNATI: #2 Centerless
CINCINNATI: 6"x18" & 10"x22" Hydr. Filmatic
BROWN & SHARPE: #10 & #23 Plain

GRINDERS—INTERNAL

HEALD: 70A Plain
HEALD: 72A3, 72A5 Plain & Univ.
HEALD: 72A3 Sizematic Centerless
HEALD: 72A5 Sizematic
HEALD: 172 Sizematic Gap Bed
BRYANT: 112 Universal, Hydr.
BRYANT: 16-28 Hole Grinder
BRYANT: 24-36 Heavy Duty
RIVETT: 2104 Tool Room

GRINDERS—RADIUS

VAN NORMAN: 275, 525, 530, 535, 545 USC.
VAN NORMAN: 23½ Universal
WICKMAN: Optical Profile (new)

GRINDERS—SURFACE

THOMPSON: 8"x12"x18" Type B
THOMPSON: 12"x12"x40" Type B
THOMPSON: 12"x18"x96" Type C
THOMPSON: 30"x30"x120" Type C
HEALD: #22 Rotary—12" Chuck
ARTER: A-1-8" Rotary
GARDNER: 120A Opposed Head Disc

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*WEBSTER & BENNETT: Vertical Boring Mills 36", 40", & 60"
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*HERBERT: Automatic Single Spindle Chuckers
*NIFE: Universal Tool & Cutter Grinder
SYKES: Herringbone, Helical & Spur Gear Machinery
RUSSELL: Cold Saws, 8" & 10" capacity
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WICKMAN: Optical Profile Grinder
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NORTON: 22Fx40" Hand

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FELLOWS: #12-C Spacing Tester
GLEASON: #13 Universal Tester
GLEASON #4 & #9 Bevel Gear Testers, Hand & Power Operated
GLEASON: 5" Bevel Gear Tester
ILLINOIS: #224 Involute Checker
RED RING: 81C-12" Gear Tester

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HEALD: 48A S.E. 2-spindle
HEALD: 47A S.E. 2-spindle
HEALD: 46B Double End

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LEBLOND: 25"x60" Engine Lathe, raised to swing 40"

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BULLARD: 24", 36" Vert. Spiral Drive
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JONES & LAMSON: 7A & 8A Saddle Type
HERBERT: #0x½", #2Dx1½" Ram, #4x2" Saddle (New)
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BAKER: 217 Upright H.D.
FOSDICK: #48M Upright H.B.
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ARCHDALE: Radial, all sizes (New)

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1404 K & T bed type prod. mill, late type
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presses 500 ton Erie
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6"x18" Cincinnati Plain Hydraulic
6"x30" Norton Type C Hydraulic Plain, 1940
10"x18" Norton Model C Plain Hydraulic, 1942
10"x36" Norton Plain, 1940
14"x48" Cincinnati Plain, 1942
8" No. 20 Heald Rotary Surface
12" No. 3 Arter Rotary Surface
No. 25A Heald Hydraulic Rotary Surface, 27" dia. chuck
No. 300 Hanchett Hyd. Vertical Surface
No. 1 Brown & Sharpe Universal, 1940
No. 2 Cincinnati Centerless, 1941

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Three #0 Waterbury Farrel DSSD Toggle Headers
No. 188F Manville SSSD Ball Header
No. 250C Manville SSSD Ball Header
No. 250C Manville SSSD Header
No. 2B and No. 2C Manville Horizontal Thread Rollers
No. 30 Waterbury Farrel Horizontal Thread Roller
1¼" National Precision Nut Tapper
No. 2 Waterbury Farrel Nut Tapper
#10 Waterbury Farrel Inclined Thread Roller

LATHES

14"x30" Hendey Geared Head, 1942
18"x12' Hendey Geared Head
20"x48" Lodge & Shipley Geared Head, 1942
43"x108" Niles Heavy Duty Geared Head, 1943
#3 Hendey Hi-Speed Turning Lathe

PRODUCTION MILLING MACHINES

No. 4-36 Cincinnati Hydromatic Plain, 1942
No. 5-48 Cincinnati Hydromatic Plain, 1943
No. 33 Sundstrand Duplex Rigidmil, 1941

PLAIN MILLING MACHINES

No. 2H Kearney & Trecker, 1942
No. 2SP and 3SP Van Norman, 1941
No. 2S Van Norman Ram type, 1943
No. 2 Cincinnati High Speed Die Type Plain
No. 4 Cincinnati High Speed Dial Type
No. 5HM Kearney & Trecker, 1943

UNIVERSAL MILLING MACHINES

No. 2A Brown & Sharpe—1942
No. 3SU Van Norman, 1943

VERTICAL MILLING MACHINES

No. 2 Cincinnati Dial Type Medium Speed, 1942
No. 2 Standard Brown & Sharpe, 1942
#3V Van Norman, 1943

PLANERS

42"x42"x18' Gray
48"x48"x26' Niles Bement Pond
72"x72"x14' Cincinnati

TURRET LATHES

No. 1 Warner & Swasey Elec. Head, 1940
No. 4 Warner & Swasey Univ. Grd. Hd. 1942
No. 1A Warner & Swasey Universal Grd. Hd.
No. 2A Warner & Swasey Universal Grd. Head
No. 5 Gisholt Universal Geared Head
No. 1L Gisholt Universal Gearec. Head, 1942
No. 7B Jones & Lamson Universal Grd. Head

SHAPERS

16" Cincinnati, 1940

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Standard motor and electrical controls
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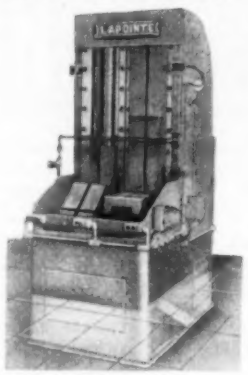

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BL-3620 Keller Duplicator
BL-2416 Keller Duplicator
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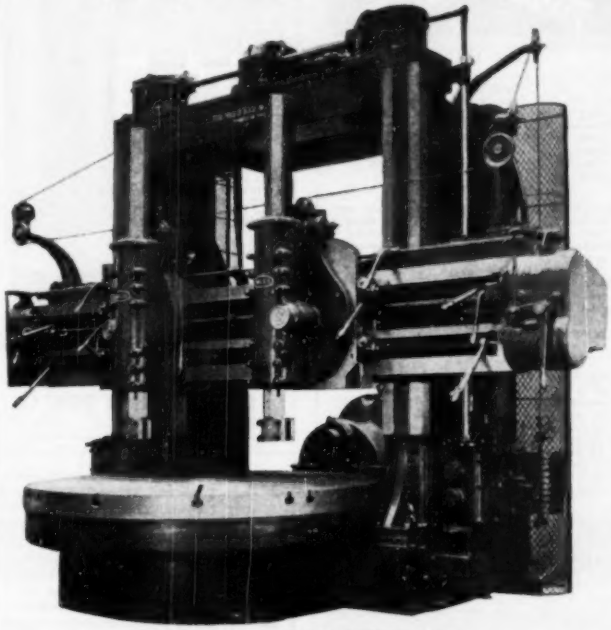

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8 spindle 1⅝" Cone, m.d., latest
4 spindle 1¼" Conomatic, m.d., bar, 1942 machine
4 spindle 1½"x6" Conomatic, m.d., bar, 1942 machine
No. 6A Potter & Johnston, m.d.
No. 6C Potter & Johnston, m.d.
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20x25" Jones & Lamson, m.d., latest
4 spindle 2¼" Cleveland Model "K", m.d.
2¼" Gridley Single Spindle, m.d.
2½" Cleveland Model A, m.d.
4¼" Cleveland Model A, m.d.
4½" Cleveland Model A, m.d.
5½" Cleveland Model A, m.d.
6" Cleveland Model A, m.d.
7¼" Cleveland Model A, m.d.

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No. 0 Giddings & Lewis, m.d., 3½" bar
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3½" bar Landis Floor Type, m.d.
No. 25T Giddings & Lewis, m.d., 2½" bar, latest
No. 3I Lucas, 3" bar, m.d.
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5½" bar Niles, m.d.
10" bar Sellers Floor Type, m.d.

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42" Bullard Spiral Drive, m.d., with side head
42" Colburn H.D., m.d., 2 swivel heads
42" Colburn, m.d., 1 swivel head, 1 turret head, p.r.t.
42" King, belted m.d., 2 swivel heads, p.r.t.
42" King, m.d., 1 turret head, 1 side head
48" Colburn H.D., m.d., 1 turret head, 1 swivel head
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20"x96" cc AMERICAN 12 Speed Timken Head Lathe, taper, rapid traverse, 1938
20"x12' cc MONARCH Lathe, 1942
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48"x30' NILES Heavy Duty Geared Head Engine Lathe, new 1939, taper, steady rests, MD
60"x20' NILES BEMENT POND 24 Speed Geared Head Lathe, taper, steady rest
No. 3L GISHOLT Turret Lathe, preselector head, bar feed, complete collets, taper, threading attachments, chuck, 1942.
20"x96" NORTON Type A Cylindrical Grinder
4' HAMMOND Jackknife Radial, 1942
36" BULLARD New Era Vertical Turret Lathe
84" CONSOLIDATED COLBURN Vertical Boring Mill, 2 swivel heads, rapid traverse, AC —MD
No. 3 CINCINNATI Plain Mill, Vertical Head, 1941

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CONOMATIC 2⅝" 6 Spindle
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HEALD #81 Centerless Int.; Sizematic
HEALD #81 Centerless Int.; Gagematic
NORTON 6" x 18" Surface
BROWN & SHARPE #13 Universal Tool & Cutter
BROWN & SHARPE #10 Cutter & Tool
HANCHETT #214 Double Spindle
PORTER CABLE Abrasive Belt Sander
TAFT PIERCE 6" Rotary Surface
WICKMAN Profile Grinder
CINCINNATI #2 Centerless, Model ER "Filmatic"
NORTON 6"x18" Type C, Pl. Cyl., Hyd.
LANDIS 4"x18" Type H, Pl. Cyl. Hyd.
HEALD #22 Rotary Surface, 12", Latest

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5" bar Jones planer type
41½" Lucas No. 33 table type
100" Niles Bement Pond 2-head vert.
No. 49 Heald dbl. end 2-spdl.

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10 ton 36" Colonial dbl. ram surface
15 ton 36" American dbl. ram surface

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12 spdl. Baush rail type No. 3 MT
42 spdl. No. B16 Natco No. 2 MT

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24" 4-spdl. Allen HDFD No. 2 MT
24" 6-spdl. Foote-Burt hand feed No. 2 MT
24" 4-spdl. Demco hand feed No. 2 MT

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Baker 30HO, and No. 217 3 spdl.
Barnes No. 201½ all geared

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Fellows No. 72 gear shaper
Barber Col. Nos. 3, 6-10, A & T
Gould & E 18H, 12H, 12HS, 8H
Gleason 3" spiral bevel generator
Red Ring 8"-12" gear shaver
Adams 5M hobber and spline miller

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Cincinnati 12x36 univ., No. 2 centerless
Landis 4x12, 4x18, 10x18, 10x24, 10x36, 14x36
Norton 6x18, 10x36, 10-14x72, 22x36

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Hanchett 22" and 30"

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Heald 72A3 and 5, plain and Size-matic No. 75 hand feed
Bryant 16A16 internal and face, Nos. 16-28, 16-38, 16CP16 and 24-36.

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HAMMERS

No. 5M Nazel pneumatic forging

HONES & LAPPERS

No. 307 Barnes vert. hone
No. 26 Heald Hydrolappers
No. 10U Heald lapper
No. 2F 36" Heald hand lapper

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ENGINE LATHES

LeBlond late 25"x48" centers
Bridgeford 36"x9' centers heavy duty

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TURRET LATHES

W&S 3A, 1A, 4 and 3
Gisholt Nos. 3AL, 2L, 5, 4 and 3
Bullard 24" and 36" vert.

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AUTOMATIC MILLERS

Cincinnati 08, 08 R&F, 1-12, 1-18, 2-18, 2-18 R&F, 2-24, 3-24, 3-24 duplex, 34-36, 34-36 duplex, 4-36, 4-48, 5-48, 56-72, 56-90
Milwaukee No. M18, M24, 1224
Brown & Sharpe No. 12 electrically controlled automatic

VERTICAL MILLERS

Milwaukee 2H and 3H
Cincinnati 2M, 2, No. 3HSDT, No. 4
Van Norman No. 3V
Kempsmith Maxi-miller
Vernon vert. miller and jig borer

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Cinn. #4 Dial Type, Medium Speed, wkg. tbl. 78½"x16½", range 42"x14"x20" (very late)
Milwaukee #5H med. spd. wkg. tbl. 24"x18", range 52"x16"x20", rpd. trav. (very late)
Kempsmith #4 Plain motor in base Maximiller wkg. tbl. 13½"x64½", ranges: 42"x14"x20" (late)

BORING MILLS

Universal 4" bar "Tri-way", face plate to outer support 72", #6 taper, added vertical range (late).
Defiance 25A, 3¼" bar, face plate to outer support 72", #6 taper, added vert. and cross range (late)
Fisher 5" floor type, vert. travel hd. 60" hor. travel col. 110" platen (very late)
Bullard 24" and 36" "Spiral drive" 24", 36" & 42" "New Era" type, vert. 3-jaw and 4-jaw chuck tables.

LATHES

Lodge & Shipley 24"x12' 12 speed Sel. Gr. Hd. 27½" swing, 81" C.D.
Monarch 20"x72" centers model "M" 16 spd. gr. hd. 22½" swing, Monarch auto. sizing controls (late)
Bridgeford 36"x56', 15 spd. gr. hd. 38" swing, 48' C.d. mtrzd. carriage.
Niles-Bement-Pond 48"x30' centers heavy duty gear head 51" swing, 30 HP AC motor drive. Used short while (late)

TURRET LATHES

Warner & Swasey #3, 1¼" cap., #4 2" cap., #5 2½" cap., ram type universal, bar and chucking, quantity of tooling. (Late)
Jones & Lamson #5, 2½" cap., ram type Universal bar and chucking (Late)
Jones & Lamson #7A 2½", #8A 3", #7D 2½", saddle type, universal, rpd. trav., bar and chucking tooling. (Late)
Warner & Swasey #2A 2½" cap., #3A 4½" cap., saddle type, Universal rpd. trav. full length lead screw, bar and chucking. (Late)

MISCELLANEOUS

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Nos. 3 2MH Cinci. Pl. Dial Millers, late
Nos. 3E & 3H K. T. Pl. Dial Millers, late
No. 36 Van Norman Pl. Miller, ram, '43
No. 2G Kempsmith Univ. Miller, 1943 (3)
No. 2416 Keller Duplicator, 3 dim., 3 spin.
No. 9J Gorton Elec. Duplicator, 1944.
Gear Cutter, No. 13 B. & S., spur & bevel
30"x120" cen. Axelson Lathe, T.A.
30"x120" Hanchett Planto Surface Grinder
No. 2 Stand. K. & T. Univ. Miller, Timken
Gear Gen., No. 61A Fellows, 1943
Gear Cutter, 3-36" B. & S. Spur, Late
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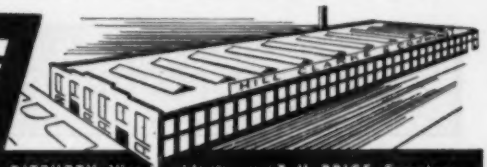

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No. 200—28" Defiance #5 Taper (1943)
No. 1-LMS Leland-Gifford (1942)
No. 2-LMS Leland-Gifford (1942)
No. 4-BM Fosdick 6 Spdl. (1942)
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3'-10" American Triple Purpose, M.D.
3'-10" Fosdick
4'-11" Carlton Radial Drill
5'-14" Fosdick
5' Western Heavy (1942)
6'-17" Fosdick Hyd. Economax Radial

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No. 61-A Fellows Gear Shaper (1942)
No. 71-A Fellows Gear Shaper (1942)
No. 7125 Fellows (1943)
No. 72 Fellows Gear Shaper
72" Cincinnati Gear Cutter
No. 3 Barber-Colman Hob Sharpener

BORING MACHINES
No. 31 Lucas 3" bar, M.D.
No. 32 Giddings & Lewis, 3½" Bar
No. 2 Lambert 4" bar
No. 48-B Heald Bore-Matic (1942)
No. 112—C Excello 2 Spdl. (1942)
42" Bullard (1944)
42" Bullard New Era
60" Colburn, M.D.
72" Niles-Bement-Pond
84" Betts, M.D.

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6"x18" Norton Type C Plain (1943)
6"x30" Norton Type C Plain (1943)
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No. 34 Abrasive Surface Grinder (1943)
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No. 36-A Hanchett Rotary Surf. (1942)
No. 72-A-3 Heald Internal (1942)
No. 72-A-5 Heald Internal (1942)
No. 16—36 Bryant Internal Gdr.

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16"x54" centers LeBlond (1941)
18"x6' American, Gdr. Head, M.D.
24"x14' Monarch
36"—48"x18' Lehman Hydratrol (1945)
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10" Sundstrands (1942, 1943)
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Model R-14 Seneca Falls Lo-Swing
No. 3 Warner & Swasey
No. 3 Jones & Lamson Univ. Turret Lathe
No. 4 Gisholt Univ. Turret Lathe (1942)
No. 4R Libby, Bar Feed (1942)
No. 5 Bardons & Oliver (1942)
No. 1-H Libby, Extra Long Bed (1942)

MILLING MACHINES
No. 2H Milwaukee Plain (1942)
No. 3B Milwaukee Plain
No. 2M Cincinnati Vert. (1941)
No. 3 Cincinnati H.P. Vertical
No. 1-1B Cincinnati Mfg. (1942)
No. 2—18" Cincinnati Rise & Fall (1941)
No. 2—18" Sundstrand-Electromil (1942)
No. 2-24 Cincinnati
No. 4-48 Cincinnati Hyd. Tracer (1942)
No. 34-48 Cincinnati Hyd. Duplex (1943)
No. 45-48 Cin. Hyd. Tracer (1941)
No. 56-72 Cincinnati Hydromatic
No. 56-90 Cincinnati Hydromatic
4½"x12" Pratt & Whit., Model C Thread Mill
6"x36" Lees-Bradner—Model HT (1943)
10"x48" Hanson-Whitney Thread (1942)
12"x24" H.T. Lees-Bradner (1942)
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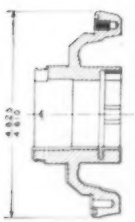
CUT-RATE, sub-standard marginal producers can expect distinguished company — namely the long established reputable manufacturer caught in the squeeze between competitive pricing and high costs. The margins are moving in — but there's room at the center of today's business picture for the manufacturer who takes advantage of the *new* standards of machine tool performance.

NEW BRITAIN
MODEL 675 AUTOMATIC CHUCKING MACHINE



Automotive transmission part, AISI C-1050 drop forged steel, finished in two operations on two New Britain Model 675 Carbide Tooled Chucking Machines. Sixty-five pieces are completed per hour with thirty-five operations performed by the two machines. They include forming, drilling, boring, turning, facing, grooving, trepanning, radius forming, chamfering, recessing and finish reaming. Unusual accuracy is required in maintaining one-thousandth tolerance on the diameters of the two bores and two-thousandths total indicator reading limits of concentricity. Typical of the ability of fully modern New Britains to make profits by making production fast, accurate and automatic.

NEW BRITAIN

Automatics

THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN-GRIDLEY MACHINE DIVISION
NEW BRITAIN, CONNECTICUT

MULTIPLE SPINDLE AUTOMATIC SCREW AND CHUCKING MACHINES • SINGLE AND DOUBLE END PRECISION STRAIGHT AND CONTOUR BORING MACHINES • LUCAS PRECISION HORIZONTAL BORING, DRILLING AND MILLING MACHINES

New TIMKEN® "00" bearing has maximum run-out of only 75 millionths of an inch!

Twice as accurate as the most accurate TIMKEN® bearing previously made!

WHEREVER high precision is a factor, the new Timken "Double-Zero" bearing opens the way for new standards of performance. The amazingly low run-out of these new bearings . . . only 75 millionths of an inch . . . makes possible closer machining tolerances in machine tools—accuracy to limits far beyond anything achieved before!

Already many manufacturers are using Timken "00" bearings to increase precision in their grinding machine spindles, small precision rolling mills, gear cutters, lathe spindles, dividing heads and other precision equipment.

The new Timken "Double-Zero" bearing is twice as accurate as the Timken "Zero"—previously the most accurate Timken bearing made. To make this new precision possible, Timken has developed measuring devices of extreme accuracy, built specialized machine tools and perfected new manufacturing processes. The steel used for the bearings is made in Timken's own mill, providing the correct combination of qualities for super-precision manufacture.

As a final step in production, to assure positive roll alignment, long-lasting precision, permanent adjustment and smoother operation, every Timken "Double-Zero" bearing goes through an extra process. A natural and true geometric contact is generated between all rotating parts.

For further information on Timken "Double-Zero" bearings, write The Timken Roller Bearing Company, Canton 6, Ohio. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.

A PRECISION TIMKEN BEARING FOR EVERY REQUIREMENT			
CLASS	**"00" (DOUBLE-ZERO)**	**"0" (ZERO)**	**"3" (THREE)**
RUN-OUT	.000075"	.000150"	.000300"
TYPES AVAILABLE	Standard Single Row	Standard Single Row	All types
SIZE RANGE	Up to 10" O.D.	Up to 12" O.D.	Up to 12" O.D.

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS

NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▱ BEARING TAKES RADIAL ◫ AND THRUST →◫← LOADS OR ANY COMBINATION ✳